

The University of Chicago

THE PRACTICABILITY
OF EMPHASIZING SPEED BEFORE
ACCURACY IN ELEMENTARY
TYPEWRITING

A DISSERTATION SUBMITTED TO THE FACULTY
OF THE SCHOOL OF BUSINESS IN CANDIDACY
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

SEPTEMBER, 1944

By
VIOLA DU FRAIN

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V. DU FRAIN

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CHAPTER I

THE PROBLEM: HISTORICAL SETTING

THE TRADITIONAL ACCURACY EMPHASIS

THE traditional accuracy emphasis in teaching elementary typewriting was based on an interpretation of Book's theory of habit formation as applied to typewriting in *The Psychology of Skill*, published first in 1908 and later republished without contextual changes in 1925,¹ and *Learning To Typewrite*, published in 1925.² Book treated the learning of the typewriting stroking skill as the acquisition of a hierarchy of habits on two levels—the single-stroking and the pattern-stroking.³ His conclusion reached from time studies of beginners and experts⁴ was that these two levels of habits developed simultaneously but not at the same rate.⁵ While he admitted

that a full use of pattern-stroking, which represented the higher-level or higher-order habit, does not begin until the elementary single-stroking habits are well fixed, his theory was definitely that these latter need not be perfected before the attention of the beginning student can with advantage be shifted to attack the former.⁶ Book's practical suggestions to teachers, however, contained many statements which might readily be interpreted as meaning that the teacher should direct the beginner to master completely the single-stroking before starting to work on the higher-order habits. Accompanying this mastery of single-stroking was a particular stress on accuracy of key locations which was assumed to require typing at a slow rate of speed.

In the first place, Book's philosophy of the teacher's role in typewriting, in setting up the learning situation so that the students would learn most efficiently,⁷ made use of the much-quoted James principles of habit formation. The first three of these principles have a direct bearing here: making the right start, never permitting an exception to occur, and always aiming at accuracy and correct technique.⁸ Making the right start

¹ William F. Book, *The Psychology of Skill* (New York: Gregg Publishing Co., 1925). This study was originally published by the University of Montana as Volume I of the *Studies in Psychology*, December, 1908.

² William F. Book, *Learning To Typewrite* (New York: Gregg Publishing Co., 1925).

³ *The Psychology of Skill*, p. 25. Book referred to these manipulative habits of the two levels as the "letter-association stage" and the "syllable-and-word-association stage." In addition to these manipulative habits were the mental habits of control.

⁴ See n. 46 below.

⁵ *The Psychology of Skill*, pp. 118-21. "The above records . . . show clearly that in learning typewriting in the manner followed by our subjects there were no graded steps or stages in which habits now of this order and now of that were developed, but that all developed together. . . . Some of the earliest records showed some letter associations in the first stages of development, others well developed and joining to form syllable and word associations, while the easier words had already

united to form phrase associations for the most common sequences of easy words" (*ibid.*, p. 119).

⁶ *Ibid.*, pp. 120-21.

⁷ Book's own subjects were self-taught; hence he was able to see where a teacher might have assisted the students in preventing certain blunders (see "Role of Teaching in Learning," in *Learning To Typewrite*, pp. 433-51).

⁸ *Ibid.*, pp. 344-51.

was held to be important because of the physiological construction of the nerve cells: as the first pathway is established, subsequent nervous currents will be directed. In the initial learning each one of Book's five steps of the single-stroking movement must be done in detail: (1) getting the copy; (2) an actual spelling or thinking of each letter to be made; (3) mentally locating it on the keyboard; (4) getting the proper finger to the key; and (5) again pronouncing the letter or initiating the final letter-making movement.⁹ It was clearly Book's opinion that the teacher should zealously guard every turning-point in the course of the letter-making movement and see that each part of that movement was made rather slowly.¹⁰ Since studies showed that many errors of typists were due to the use of the wrong finger, it was also Book's view that much attention should be given to controlling the exact direction of each letter-making movement.¹¹ Although Book was fully aware that a beginner might experience a surplus of initial movements, his expectation also was that the teacher would aid the beginner in practicing in the most efficient manner.¹² In the early stages of

learning the teacher, according to Book, should caution the learner at the start of each practice period to go slowly enough to make all his responses correct.¹³

Although Book's emphasis on the single-stroking movement admittedly is basic, at least for a minimum length of time, the stress on acquiring correct finger locations is only a part of the stroking form or technique commonly taught in elementary typewriting. In 1915 Coover's analysis of Wiese's and other experts' stroking-movement form introduced a further refined element of timing in the concept of correct stroking. The Wiese-Coover recommendation was a quick tiger-stroke movement of the finger from the home key to the desired key and return, with two seconds of relaxation on the home keys between strokes.¹⁴ This concept of quick-stroking, not stressed by Book, was not incompatible with Book's analysis of typewriting skill, because a given slow speed of strokings per minute might be achieved by combining quick strokes with long intervals of rest between strokes.

In the second place, Book's philosophy of the teacher's role as the typewriting practice continues was that the teacher should be aware of two difficulties of the learner: (1) he may be caught by the law of habit and continue to think or work on a low plane and (2) he may try to crowd ahead to the higher and more direct methods of writing before

⁹ *The Psychology of Skill*, pp. 89 and 31.

¹⁰ *Ibid.*, p. 43.

¹¹ *Learning To Typewrite*, p. 253.

¹² "In the early stages of practice the learner's efforts were not always well adapted to the work. Many purposeless motor discharges accompanied the writing, such as rigidity of the body, jerky and meaningless movements of the fingers and hands, all sorts of overflow movements, affecting various parts of the learner's body. The learner's energy could neither be released in the right amount nor advantageously directed. The following phrases are taken from the experimenter's observations of Z in his earlier tests: 'Hammers the keys, spells so loudly that he can be heard in all parts of the room, constantly wriggles about on his chair, lifts up the table with his knees, grits his teeth, trembles and literally uses his whole body to write. . . . The same was true of the other learners'" (*The Psychology of Skill*, p. 98).

¹³ *Learning To Typewrite*, pp. 347-48.

¹⁴ E. G. Wiese and J. E. Coover, *The Wiese-Coover Kinesthetic Method of Learning Touch Typing* (Baltimore: H. M. Rowe Co., 1924), pp. ii and 1-6. After the Panama-Pacific International Exposition in 1915, where Wiese gave some demonstrations of speed writing on the typewriter, Coover made measurements with an electromagnetic recorder on a kymograph of the performances of Wiese and three other speed writers.

the elementary habits are sufficiently mastered.¹⁵ While the student should always practice with the highest order habits he can use, the teacher, according to Book, should see to it that he does not try to go too fast. While Book realized full well that accuracy in details would not insure speed and might even retard speed, yet his advice is that the teacher should insist upon absolute accuracy at all times because such procedure makes the use of higher-order habits possible.¹⁶ He approved the custom, generally followed by the "best" typewriting schools, of practicing most of the time for accuracy alone, to perfect carefully the elemental associations, and only a small part of the time for speed.¹⁷ Book's writings did not indicate any specific number of lessons for perfecting elemental associations, but several times he points out that typewriting habits are slowly perfected.¹⁸ His conclusion is that "teachers of typewriting and the directors of the world's typewriting contest are right when they insist upon accuracy first and speed afterwards."¹⁹

In connection with one of the learner's "most difficult" problems—controlling the sequence of these letter-making movements—the teaching of rhythm was indorsed by Book. Anything, he said, that is done to make the letter-making movements more uniform in intensity and time will aid the learner in initiating the movements and controlling them as to both order or sequence and correctness of stroke.²⁰

¹⁵ *The Psychology of Skill*, p. 245; *Learning To Typewrite*, pp. 234, 441, and 245-46.

¹⁶ *Learning To Typewrite*, pp. 231 and 233.

¹⁷ *Ibid.*, pp. 245-46.

¹⁸ *Ibid.*, pp. 219-21; *The Psychology of Skill*, pp. 135-37.

¹⁹ *Learning To Typewrite*, p. 174.

²⁰ *Ibid.*, p. 176.

The interpretation of Book's theory of habit formation as applied to typewriting by teachers and textbook writers tended to emphasize the mastery of single strokes, with particular stress on accuracy of key locations rather than technique of movements and fast rate. While the concept of quick-stroking received some attention and rhythm was commonly taught, the speed rate in continuity writing was a slow one in order to permit the beginner to make accurate key-reaches. The correct start, as it related to accurate key-reaches, was emphasized to such an extent that the beginner was virtually placed in a strait-jacket of procedures involving correct position before the machine, correct manner of reading copy, correct manner of stroking, etc. The learning situation was so guarded that the beginner was prevented from initial errors and thus permitted to make "perfect-copy" typescripts. Habits were assumed to be set up by a few trials; hence the need for restricting the habits formed to desirable habits, not bad habits to be eliminated later only with much effort. The learning exercises were characterized by numerous repetitions of small learning units, with warnings that the student practice slowly and with conscious effort toward perfection of responses. Since habits were assumed to be fixed only after weeks and weeks of attentive repetitive practice, this type of learning exercise was continued for several weeks.

Illustrations of the traditional accuracy emphasis are easy to find in both the older typewriting texts and in the experience of many typists trained in the last four decades. The general structure of the teaching method²¹ is obvious from

²¹ It should be remembered at this point that any given teacher's method involves more than can be included here, such as vague but real personality

the textbook organization and the detailed instructions to the student, the typewriting textbooks usually being written to be self-instructive. The pattern of this accuracy emphasis is as simple as it is well known. Two widely used texts published in 1927 will serve as examples. In these texts—the Sorelle *The New Rational Typewriting*²² and the Lessenberry and Jevon *20th Century Touch Typewriting*²³—the first seven pages convey to the student the importance of the correct start,²⁴ including (a) the fact that habits are set in a very short time;²⁵ (b) the need for a correct

factors. Method may be defined as a unified, coordinated set of procedures which aim at continually directing the learning processes to definite goals.

²² Rupert P. Sorelle, *The New Rational Typewriting* (New York: Gregg Publishing Co., 1926-27).

²³ D. D. Lessenberry and Elizabeth A. Jevon, *20th Century Touch Typewriting* (Cincinnati: South-Western Publishing Co., 1927).

²⁴ "The foundations of skill in typing are laid in the first few lessons" (Sorelle, *op. cit.*, p. 1).

²⁵ "Time that you spend, in the first twelve lessons, in acquiring a correct technique will be more than saved by the speed of your progress on the remaining lessons" (*ibid.*).

"The development of skill in typewriting logically follows the formation of correct habits in handling the parts of the machine and in controlling the thought processes involved in learning to typewrite. This necessitates a procedure that must be followed for each day's work. This may vary somewhat from day to day, but certain movements must be fixed and must be a part of each day's lesson plan. It is only by developing the habit of doing the same thing in the same way that the automatic processes necessary for the development of skill in typewriting are established. The procedure outline below should be followed each day [these four items deal with the correct position at machine, insertion of paper, straightening the paper, and adjusting marginal stops]" (Lessenberry and Jevon, *op. cit.*, pp. 15-16).

"Learning to typewrite is merely a process of habit formation. It is well to remember, however, that incorrect habits are as easily acquired as correct habits. Be constantly on the alert, therefore, to develop skill according to a well-considered plan" (*ibid.*, p. 18).

position before the typewriter;²⁶ (c) the details for adjusting marginal stops and placing paper in the typewriter in order to center the copy on the page; (d) the need for the quick finger-stroke and return to the home position;²⁷ and (e) the need for deliberation in planning the stroke, getting the exact key placement in mind, making the precise reach with the finger, and bringing the finger to a rest on the home key as the next key is being planned—a slow, deliberate proc-

²⁶ See Sorelle, *op. cit.*, p. 5; for directions for correct posture at the typewriter.

"Feet flat on the floor, one foot slightly forward. Shoulders erect. Lean from the hips toward the machine. Sit somewhat to the right of the center of the keyboard. The letter 'k' may be used as an approximate centering point. This will give the correct alignment with the diagonal arrangement of the keyboard" (Lessenberry and Jevon, *op. cit.*, p. 5).

See Sorelle, *op. cit.*, p. 7, for exact position of hands on keyboard.

²⁷ "*Method of Stroking*: At the start of the work in typing, obviously the locating of the key, or making the reach, is the most important factor. In fact, a very large part of your attention will be occupied with that one thing until the movements of the letter locations are so well fixed through the kinesthetic sense that little attention need be given to the movement.

"But it is quite important that the recoil from the key also be given attention. . . . The keys should be struck with a sharp, positive stroke in order to give the type bar an opportunity to snap back in place quickly. In a properly executed stroke, the finger is off the key *before* the type strikes the platen. Striking the key with a sharp, rapid tap with instant finger recoil also has an important psychological effect; it energizes and speeds up the stroking and intensifies the 'feel' of the stroke" (Sorelle, *op. cit.*, pp. 3-4).

"*Stroke and Release of the Key*: After establishing a sense of intimacy between the controlling fingers and their home key positions, the most important single phase of the work in Part I will be an intelligent understanding and an accurate use of the 'snatch' stroke. The 'snatch' stroke is a quick, decisive, forceful blow to the center of the key, with an immediate release. The finger does not follow the key, but is swiftly pulled back toward the palm of the hand. . . . Remember that the emphasis is placed upon the release rather than upon the stroke" (Lessenberry and Jevon, *op. cit.*, p. 13).

ess of continued writing.²⁸ Although the texts deal with the desired techniques in stroking and other machine manipulations, the emphasis on attaining these techniques is overshadowed by the greater emphasis on accuracy. Speed is also subordinated to accuracy.²⁹ In many instances, if not in most cases, it was assumed that the student would continue working on a copy until he attained a perfect copy.³⁰ The ways of knowing and

demonstrating differences in correct technique (accuracy of process) and correct copy (accuracy of product) were not adequate.

The traditional accuracy emphasis method has been criticized on several counts. One criticism is that the student became so accustomed to speeds under 200 strokes per minute that he had difficulty in increasing his rate above that level. Although he is very accurate at the lower speeds, his efforts to increase his speed are frustrated by the many errors which occur in these trials. His useful habits for writing accurately at a slow speed prove to be handicaps which inhibit his attempts to write at faster speeds. Another criticism is that the student dislikes typewriting because of the straitjacket in which he is placed and because of the monotonous repetitions of short, meaningless learning units.

CONTEMPORARY SPEED-ACCURACY EMPHASES

The speed-accuracy emphases of contemporary methods of teaching elementary typewriting are characterized by deviations and disagreements. These divergencies, together with trends in textbook materials, suggest some inadequacies in interpretations of the theory of habit formation associated with the

Typists (1920): "Write ten perfect lines of each" (Lesson 5); (3) Joseph P. Degan, *New Manual of Natural Touch and Speed Typewriting, 25th Edition* (Milwaukee, Wis.: C. N. Caspar Co., 1929): "Make five perfect lines; . . . ten perfect lines; . . . twenty perfect lines; . . . two perfect copies. . . . Write five consecutive perfect lines; . . . write four consecutive perfect lines." Some texts definitely direct the students "not to pass from one drill to another until you have mastered the drill in hand" (*ibid.*, p. 9). In *Reach-Touch Typewriting* (1926), the students are told (p. 10) not to be "discouraged if it takes several days to secure a satisfactory copy." ("Satisfactory copy" is defined as a perfect copy written by touch.)

²⁸ "Write slowly and carefully, thinking of the location of the keys, and the movement in making the reaches. If you find errors, repeat. . . . Type an exact copy of the following" (Sorelle, *op. cit.*, pp. 9-10 and 13).

"Write at a slow rate of speed, giving careful thought to the rhythm and continuity of writing, and to the correct and accurate stroking of the keys. . . . Do all of your work . . . accurately. . . . Think each letter as you write and keep writing. . . . It is the continuous writing at a slow, rhythmic speed that develops the best technique and the best habits of typing. Try to write this entire exercise without a break in the continuity of writing. *Release the key quickly*" (Lessenberry and Jevon, *op. cit.*, Lessons 1, 20, and 29).

²⁹ "Accuracy first' is a good slogan. Avoid mistakes. The consciousness of having made a mistake lingers, to trip you at the first unguarded moment" (Sorrell, *op. cit.*, p. 1).

Other texts contain statements concerning speed and accuracy: (1) In F. M. Butts, *Reach-Touch Typewriting* (New York: Ronald Press Co., 1926), p. 15, the student is told to be "careful, write slowly, and think about each reach before you make it." On p. 2 the author states that no mention is made of speed in the first semester until the "correct writing habits" are "established and integrated by repeated reviews." (2) In C. E. Birch, *The Vocabulary Method of Training Touch Typists* (Battle Creek, Mich.: Ellis Publishing Co., 1920), p. 4, we find: "Perfect Work.—We might appropriately call this the 'accuracy first' course, as we believe so strongly in turning in perfect work." On p. 10: "Write only as rapidly as you can write ACCURATELY."

³⁰ Directions for perfect typescripts are stated differently in various texts but have essentially the same meaning. (1) *The New Rational Typewriting* (1926-27): "Type an exact copy. . . . Make one extra copy of the group for each error discovered. . . . Continue typing the sentence in which errors occur until you have five correct copies" (pp. 13 and 34); (2) *The Vocabulary Method of Training Touch*

traditional accuracy emphasis. The wide range of differences in combining speed and accuracy goals can be noted most effectively if the set of procedures, i.e., the method, is analyzed with respect to five factors: (1) introductory learning of the keyboard; (2) unit of copy material; (3) length of writing interval; (4) accuracy; and (5) speed.

Introductory learning of the keyboard may be defined as giving the student some experience in using the alphabetic-letter and punctuation-mark keys, according to a systematic fingering.

Unit of copy material has three elements: content, size, and number of times practiced. The content of the copy material of early lessons often is restricted to alphabetic letters with little, if any, thought content. Size ranges from one or more strokes to words, phrases, sentences, and paragraphs. If the unit of copy material is small, it may be repeated within an exercise as many as sixty or more times, and in the course of one lesson the exercise itself may be repeated several times. In writings in which speed measurements are made, it is assumed that the copy material typed conforms to what is taken to be standard limitations.³¹

Length of writing interval means the number of minutes the student is writing continuously on one exercise. It may or may not be definitely quantified; it may vary from only a fraction of a minute to one minute, two minutes, and on up to ten minutes or more.

Accuracy is an abstraction which describes the finger movement in terms of

³¹ Standard copy for typewriting tests usually is nontechnical in content, 70 per cent of which are words from the 1,000 most frequently used words of some published list, such as Horn's, and the remaining 30 per cent, derivatives or less frequent words. Sometimes such quantitative measurements as the syllabic count, letter frequency, etc., are also included.

the product, the typescript. It is predicated upon the assumption that correct typescript means that the proper finger, according to the fingering system used, moved with the right force and the right sequence in time to the right key. Accuracy means little unless it is quantified. For convenience, it is usually quantified negatively, in terms of erroneous rather than correct strokes, either in averaged number of errors per 100 strokes or in averaged number of errors per minute.³² As a variable on a continuum (in this dissertation plotted on the horizontal axis—see Fig. 4, p. 26), accuracy might extend from 0 to 100 per cent in terms of errors per 100 strokes or from 0 to the total number of strokes written per minute in terms of errors per minute.³³

Speed is also an abstraction which means little unless it is quantified by a measuring unit denoting rate of finger movements, that is, typescript strokes written in the average minute.³⁴ It is a variable on a continuum (in this dissertation plotted on the vertical axis—see Fig. 4), which extends from 0 to 775

³² Errors may be counted in terms of words rather than strokes. This is less exact than counting in terms of strokes, although in many instances, when there is only one error in a word, the practical differences are insignificant.

³³ Because of the manner in which scores or rates are calculated, in net speeds which alone are published, it is difficult to estimate practical standards of accuracy. Perfect accuracy is usually not expected under the stress of a speed test. The world champion in 1941 made 40 errors in 46,580 strokes, or 0.085 errors per 100 strokes. In errors per minutes, since she wrote for 60 minutes, the rate is 0.6 error per minute. A common criterion is one error per minute. In describing a typist's output, both gross speed and error rates are important.

³⁴ Being an average, it does not indicate the variability among the various minutes or within any given minute. It is in no sense a refined measure of the single-stroking-movement time, nor does it account for the amount of time between the stroking movements when the fingers are at rest.

or more strokes per minute.³⁵ The word "speed" does not describe the timing of the single stroke but rather indicates the average number of strokes per minute. For example, a given speed might be achieved by combining quick strokes with long intervals or by combining slow strokes with short intervals. Neither does speed describe the temporal evenness of the strokes, or rhythm, commonly accepted as a desirable quality of type-writing.

The divergencies of speed and accuracy emphases in contemporary teaching methods were evident in an analysis of five textbooks, one published in 1932 and four published since 1939.³⁶ In the first six lessons, speed goals are quantified in four texts and not quantified in one. The rates in the four texts vary from 50-60 to 100-200 strokes per minute. In two texts the rates are expected

³⁵ The world champion typist wrote 775 strokes per minute for one hour on an electric typewriter in 1941, the last year the contest was held.

³⁶ The five texts are: (1) Esta Ross Stuart, *Stuart Typing* (New York: D. C. Heath & Co., 1932); (2) August Dvorak, Nellie L. Merrick, Gertrude Catherine Ford, and William L. Dealey, *Scientific Typewriting* (New York: American Book Co., 1939); (3) Rupert P. Sorelle, Harold H. Smith, William R. Foster, and Clyde I. Blanchard, *Gregg Typing, Third Edition* (New York: Gregg Publishing Co., 1941); (4) D. D. Lessenberry, *20th Century Typewriting, 4th Edition* (Cincinnati: South-Western Publishing Co., 1942); and (5) E. G. Blackstone, *Speed Typing* (New York: Prentice-Hall, Inc., 1943).

The 1932 edition of *Stuart Typing* was purposely used in this analysis because this edition contains more detailed directions to students, clearly portraying a certain point of view on accuracy. This 1932 edition was revised in 1939, and in a letter dated November 10, 1944, the author states that she has changed her point of view on accuracy since 1932.

Examination of textbook materials in terms of these five factors may provide a more objective and accurate picture of the method involved than the author's own statements concerning his method. In the latter statements it is often difficult to isolate these factors from the author's techniques and devices for attaining his objectives.

to remain at a constant level; in one text the rate is to be gradually increased; and in another the rate is to be on three levels, according to the kind of material being typed. Along with these divergencies in speed goals are divergencies in accuracy goals. In one text 100 per cent accuracy is the goal from the start; in a second, a "correct copy" is expected after Lesson 3; in a third, a reasonable accuracy is expected from the start; in a fourth, the accuracy is not quantified, although the aim is for "control"; and, in a fifth, the student is told to expect many errors. Along with these varying speed and accuracy goals are other variations: (1) The number of alphabetic keys vary from just a few to more than half the alphabet, and the numbers of fingers used vary from just a few to all of them. (2) The units of copy material vary from copy limited to two-letter high-frequency words and much repetition to copy not so limited and consisting of groups of short sentences. (3) The lengths of writing interval vary from less than one minute to several minutes, with some texts indicating the interval and some not.

After Lesson 6 and continuing through Lesson 25, normally five weeks, these wide divergencies persist. The speed rates in two texts still remain on the 100- and 200-stroke levels, respectively. In the third text the rate is expected to increase gradually, forced by the use of a pacer; in the fourth, the rate is expected to increase gradually as the student tries out different levels on different materials; and, in the fifth, the rate is forced periodically by sharp increases and high error rates, followed by a temporary sharp decrease in speed while the errors are eliminated. The accuracy goals, too, vary. They vary from 100 per cent, with a limited number of errors permitted for

a passing grade, to a reasonable accuracy. Correction drills use different methods of eliminating errors, probably resulting in variant degrees of emphases on accuracy. The 50-stroke penalty for errors is used in three texts, starting at different points (Lessons 6, 12, and 15), and the five-stroke penalty is used by one text. Other divergencies are noted in related factors: (a) Paragraphed material is used, starting at different points (Lessons 5, 6, 10, and 12); this material usually is accompanied by a cumulated stroke-count, but in one text paragraphed material is used from Lesson 5 on and not counted until Lesson 15. (b) Timed writings are regularly used, starting at different points (Lessons 6, 7, 12, 13, and 15) for five-, three-, five-, five-, and one-minute intervals, respectively; five-minute writings are regularly used, starting at Lessons 6, 13, 17, 24, and 32.

These noted divergencies in the five textbooks may be viewed in the trends exemplified in many current textbooks: (a) a greater consciousness of time on the part of the authors, indicated by the breakdown of the lesson into major periods or by stating, either in the student's text or in the teacher's manual, a definite number of minutes for each exercise; (b) an earlier introduction of timed tests, accompanied by cumulated stroke-counts at the ends of all the copy-material lines; (c) an earlier introduction to all alphabetic keys, within six lessons, for example, instead of twenty-five to thirty lessons; (c) an earlier introduction to continuous writing on paragraphed material; (d) some slight modifications of the International Typewriting Rules' 50-stroke penalty for errors, and (e) direction of the student's attention in the initial lessons to techniques of finger movements rather than to accuracy of

key-reaches and resultant typescript. All in all, a clarification of the issues in teaching elementary typewriting is needed. The problem of the practicability of emphasizing speed before accuracy will now be presented.

THE SPEED-FIRST EMPHASIS

The important problem of emphasizing speed before accuracy³⁷ in learning motor skills was raised by Gilbreth's time-and-motion studies of bricklaying and other industrial skills. In these studies it was noted that the master-mason used different movements when normally plying his trade at a fast speed and when demonstrating to an apprentice. With the chronocyclegraph technique,³⁸ further data were gathered on the differences in the paths of motions made with the major emphasis on speed and those made with the major emphasis on accuracy. These differences in spatial form were attributed to variations in muscular tensions.³⁹ As a result of these

³⁷ "One of the most important problems in training is whether attention should first be concentrated upon accuracy or first upon speed in teaching skill" (Morris Viteles, *Industrial Psychology* [New York: W. W. Norton & Co., Inc., 1932], pp. 428-29).

³⁸ The motion models are made by observing the chronocyclegraph through the stereoscope and bending a wire until "it coincides with the part of the motion observed. . . . The motion model, upon its completion, is painted black. The spots upon the chronocyclegraph are represented by spots painted upon the model [indicating the direction of motion]" (Frank B. and L. M. Gilbreth, *Applied Motion Study* [New York: Macmillan Co., 1919], pp. 122-23).

³⁹ Practical differences between types of muscular tensions, ballistic and tense, in the skill of piano-playing are discussed by L. D. Hartson in "Contrasting Approaches to the Analysis of Skilled Movements," *Journal of General Psychology*, XX (April, 1939), 274-79. In the ballistic type the muscle groups contract without much opposition, and the limb swings freely; e.g., in piano-playing, the finger is thrown with a rapid contraction of one set of finger muscles and pulled back with the same type of contraction of the opposite set of finger muscles. In the

and other studies, the generalization was made that, when learning motor skills in which speed is a vital part of the standard method of the expert, the beginner should be taught the faster speed first, regardless of the quality of the output.⁴⁰ It was thought that the learning time required for all motor skills would be shortened, even though time and effort would be needed for the beginner to eliminate his initial error habits.⁴¹

According to Gilbreth, the rate of speed implied in the speed-first emphasis is the rate of the standard method and not necessarily the highest rate. The standard method is that method which produces the desired results most efficiently.⁴² It appeared that for each motor skill there is a one best method⁴³ and that the short cut to learning is to get the beginner into the rhythm of this movement path at once. If this were an absolute impossibility, it was recommended that a compromise be made with

tense type the groups of muscles about a pivot joint contract in opposition to each other, the limb moving to the extent of the algebraic sum of opposing muscle strengths.

⁴⁰ "The insistence on quality first and right methods second was entirely wrong, since it allowed of the formation of wrong habits of motions, the result of which is a lifelong detriment to the user. The proper insistence is upon right methods at standard speed first, and quality of work product second" (Gilbreth and Gilbreth, *op. cit.*, p. 112).

⁴¹ "It having been shown that fast motions are different from slow motions, it becomes self-evident that, in accordance with the laws of habit formation, the learner must be taught the standard speed of motions from the first day. If he is not, he will not form properly the habit of using the forces that lie in his own body under his own control, of which he is usually at present unaware" (*ibid.*).

⁴² *Ibid.*, p. 120.

⁴³ This concept of "one best method" has been challenged. Critics condemn the manner in which the one best method is formulated by synthesizing partial movements of a number of experts; they say it is unreasonable also to assume that any one method would be best for all individuals.

the speed that was as near as possible to the rate of the standard method. In making this suggestion, Gilbreth did not consider that he was permanently neglecting the training for quality; he felt that if the movement were made at the proper speed, the results would have a high quality or, at least, that quality would soon take care of itself. If the results did not have a high quality, he recommended definite corrective steps for improving the quality.⁴⁴

The application of the speed-first theory to typewriting learning raises the question of what rate of speed is best for beginners.⁴⁵ According to present techniques of teaching, the expert's speed of 300 strokes per minute or more, in terms of continuous writing, appears to be impracticable. No standard method has been established scientifically by detailed time-and-motion studies of the typist's finger movements. However, a few studies have recorded time measurements of the typewriter-key printings, and from these data inferences have been drawn

⁴⁴ "The beginner should be taught to do his work immediately with motions of standard speed. Quality should be attended to, however, in every instance: (a) by having the learner stop constructive work long enough to correct what he has done, or do it over again until it is of proper quality, care being taken not to confuse the doing with the correcting; and (b) by having someone else correct the work as many times as is necessary, until it becomes of proper quality" (Gilbreth and Gilbreth, *op. cit.*, p. 112).

⁴⁵ It is possible only to estimate speed standards for various levels of skills in typewriting, since most published records are stated in terms of net speed scores, without the amounts of the penalty deducted for errors. The following estimates are given:

	Strokes per Minute
Untrained beginner (in 10-min. writings):	
After initial orientation to keyboard.....	25
After 1 semester of 75-90 50-min. practices....	125
After 2 semesters of 150-80 50-min. practices..	150
After 3 semesters of 225-70 50-min. practices..	175
After 4 semesters of 300-360 50-min. practices.	200
Average office worker.....	210
Speed required for some office jobs.....	300
Novice champions (30-min. writings).....	400
Professional champion (60-min. writing).....	775

about the nature of the standard method in typewriting, namely, that the finger movements of faster typewriting tend to be characterized by pattern responses.

Book's study (1909), mentioned previously, involved the time records of typescript strokes of typists who typed at various speed levels⁴⁶ and indicated the grouping of strokes in unique time patterns, which were called typing on the word or phrase level. On the basis of these data, the assumption was made that in this pattern typing the subsequent letter-making movements in the series were touched off, not only by the visual stimuli of the copy, but also by the kinesthetic sensations of the earlier responses.⁴⁷ This assumption was further substantiated by Coover's study of Wiese and others in 1915, mentioned previously. This latter study showed that experts' speeds were greatly decreased when the copy material was made visible to them at only one stroke at a time and that, conversely, their speeds were greatly increased when the copy material appeared in larger units, up to seven letters at a time.⁴⁸ While

⁴⁶ An "accurate record of what each learner did while at the typewriter . . . was obtained by means of electrical connections between the machine and three Duprez markers writing upon a kymograph drum in such a way that everything the subject did on the machine was recorded. Every time he struck a letter, every time a word was finished, or the carriage moved back for beginning a line, the fact was recorded so that the time consumed in the performance as well as the manner of its execution could be determined from the record" (Book, *The Psychology of Skill*, pp. 4-5).

⁴⁷ In the typing of the word "when," the striking of the letter *w* sets off the *h*, which in turn sets off the *e* and then follows the *n*. This is typing in word patterns or patterns of strokes instead of letter by letter. Book quotes Wiese concerning learning key-reaches through attention to the kinesthetic sensations produced by making the correct finger movements (see *Learning To Typewrite*, p. 171).

⁴⁸ J. E. Coover, "A Method of Teaching Typewriting Based upon a Psychological Analysis of

these two studies indicated inferentially that the finger movements of faster typewriting tend to be characterized by pattern responses, they failed to designate the speed levels at which these results are produced most efficiently, for example, whether at 200 strokes per minute, at 300 strokes, or at other rates.⁴⁹

The problem of applying the speed-first theory to typewriting learning should be considered from the standpoint of the learner's capacities as well as from that of the standard method of operation. That this was recognized by Gilbreth in connection with his generalizations for industrial training has already been shown. Accepted principles of educational psychology require (1) that the learning experiences be set up in terms of the learner's capacities in order to give him an opportunity for trial-and-error performance, since no substitute for trial and error in motor learning has been found, and (2) that the learning experiences provide opportunities for the learner to have successful trials in order to establish the desired associations and also to be properly motivated.

Although distinctly taking cognizance of higher initial speed goals and ways of pushing up speeds, none of the five textbook methods analyzed herein appears wholeheartedly to follow Gilbreth's suggestion for teaching speed first, regardless of errors, in the continuous writing process.

Expert Typing," *Proceedings of the National Education Association*, 1927, LXI, 561-67.

⁴⁹ From sheer observation of the complex typewriting processes, it appears that typing at 300 strokes per minute involves finger-movement paths and tensions quite different from typing at 200 strokes per minute.

CHAPTER II

THE EXPERIMENT

INTRODUCTION

THIS experiment was suggested by Gilbreth's generalization that in learning motor skills the beginner should be taught speed first, regardless of the quality of the output. No attempt is made to devise and defend any one complete method of teaching elementary typewriting. Rather, the experiment considers method only sufficiently to enable a testing of this one element in the total learning process, namely, the practicability of emphasizing speed before accuracy in elementary typewriting.¹ The goal of determining the one best method for teaching elementary typewriting is idealistic inasmuch as the number of methods which are possible by different combinations of variables approaches infinity. An experiment must be limited to a relatively small number of variables because of the time and effort required and the difficulties involved in controlling the factors included.

Following the Gilbreth suggestion, this experiment was planned definitely to develop speed first before accuracy in the experimental group, seeking to have the students experience the highest possible speed levels in continuity typewriting as early as possible in the learning process. After they had attained an arbitrary speed level, the plan was to direct them to shift attention to accuracy while

retaining their high speed level. Once they reached an arbitrary degree of accuracy, the plan was to have them repeat this cycle of speed and accuracy emphases, aiming for an arbitrary higher speed level and, later, for the arbitrary degree of accuracy, the same as before. The plan was to compare the results of this experimental method with results obtained by using a contrasting control method which directed the students to aim primarily for accuracy throughout the seventy lessons, with timed writings in alternate lessons.

The purpose of this experiment may be stated more pointedly as seeking proof of the validity of the following hypotheses:

Hypothesis I. Higher speed level first.—If elementary typewriting students attend to speed of continuous writing immediately after orientation, ignoring typescript errors, they will be able to force their speed to the 100-stroke level sooner than if they attend primarily to accuracy. Later on, they will be able to use this technique to force their speed to the 150-stroke level.

Hypothesis II. (a) Elimination of errors.—These students will be able to reduce their high error rate within one semester to a level which approximates or equals that of students who gave primary attention to accuracy.

b) Retention of speed level.—These students will simultaneously be able to retain their high speed level while reducing their error rate.

Hypothesis III. Terminal speed and accuracy rates.—These students will have a terminal speed rate which is higher than the students who attend primarily to accuracy, and they will have a terminal accuracy rate which is equal to that of the latter students at the end of seventy lessons.

¹ Elementary typewriting means beginning typewriting, a course in senior high school extending over one semester of from seventy-five to ninety fifty-minute lessons.

It was hoped that suggestions could be made, on the basis of findings, for teaching methods and further experimentation and that data might be obtained from which generalizations might be induced concerning the phenomena of habit formation in typewriting learning.

THE PAIRED CLASSES

A pair of experimental and control classes in each of four high schools was taught by one teacher experienced in teaching elementary typewriting in her own school situation. These four teachers had previously encountered difficulties in teaching speed to students who had been started with the accuracy emphasis, and they were interested in finding a teaching method which would solve this practical problem. So three of them volunteered to do pre-experimental work in 1938 and to participate in the experiment in 1939. The fourth volunteered to run the experiment in her classes in 1942. The teachers' possible biases for and against the two methods were discussed, resulting, it is believed, in each teacher's making a sincere attempt to give both classes an equal opportunity. The natural bias or enthusiasm for the novel experimental method was likely offset by the five years or more of experience in teaching by the control method, or one nearly like it. All classes were composed of students who had had no previous experience in typewriting. In each pair of classes the experimental class was matched, student by student, to the control class on the bases of race, sex, approximate age (an interval of two years), and, where possible, averaged English grades for four semesters. The experimental classes consisted of the following numbers and sexes:

In School A, 38 students (8 girls and 30 boys)

In School B, 26 students (16 girls and 10 boys)

In School C, 12 students (9 girls and 3 boys)

In School D, 17 students (13 girls and 4 boys)

The control classes for the schools included equivalent numbers of girls and boys. In three schools the experimental classes met at nine o'clock and the control classes met at ten; in one school the experimental class met at one o'clock and the control class at two. The class periods were fifty minutes in three schools and forty minutes in one (School D). The typewriters used were standard machines with the universal keyboard. A class check determined which students had typewriters available for practice outside of class. Since practice outside of class was not encouraged and so little of it was reported, it was assumed to be negligible.

The course objective for the pair of classes in School A, both experimental and control, was personal use; for the pairs in the three other schools (B, C, and D), vocational use. The extent of the experiment in School A (spring of 1939) was 51 lessons; in Schools B and C (fall of 1939), 75 lessons; and in School D (fall of 1942), 73 lessons.²

DETAILED WRITTEN LESSON PLANS

To insure uniformity in all schools and all classes and to aid the teachers in carrying out the experimental and control teaching methods, detailed lesson plans were written and re-written many times.³

² Because the results in School A, available in the spring of 1939, showed that by Lesson 51 the Experimental-A Class had not reduced its error rate sufficiently to approximate the Control-A Class error rate, it was decided to extend the experiment in the subsequent classes to 75 lessons. This was done in Schools B and C, but in School D it proved feasible to extend the experiment to 73 lessons only.

³ The lesson plans underwent four complete revisions previous to the experiment. After the experiment was run in School A, the lesson plans were extended from 51 to 75, and a change was made in the speed-grading scale used in the experimental

These plans also served as a written record to assist in subsequent study of the data. Since such plans are likely to suffer from rigidity and inflexibility, as well as from stiltedness, an attempt was made to overcome these weaknesses; for example, a certain amount of flexibility was provided through which the teacher might check the individual student's habits while the class as a whole worked without the aid of the teacher. From the nature of the two teaching methods, it also seemed imperative that the lessons be planned ahead quite carefully, with a predetermined pattern of repetition of exercises in order to give the control classes practice on the last part of each exercise, copy material being a constant factor in the experiment.⁴

COPY MATERIALS

One hundred exercises of copy materials were written particularly for this experiment after four current texts had been tried and a survey of publications revealed no text constructed according to the specifications set up for this study. Each initial exercise contained all the alphabetic letters, in short units of words and phrases printed under simple directional keyboard charts; after Lesson 10, each exercise contained 1,000 strokes; and after Lesson 25, 1,500 strokes. Each exercise was accompanied by a cumulative stroke-count at the end of each line so that the student was aided in making a ready calculation of his speed rate. Only one exercise was printed on a page in order to help the experimental student visualize his shortages from 1,000 gross strokes, when the objective was 100 strokes per minute for

ten minutes, and later on, from 1,500 gross strokes, when the objective was 150 strokes for ten minutes. Each exercise was also broken down into three or four shorter sections, usually paragraphs, and these sections were lettered to assist the control student in identifying his copies to be graded.

These exercises were selected and constructed to meet the qualitative criteria of material that was (1) sensible and coherent, (2) of general interest to students of high-school intellectual level, and (3) of informational value. To add to the student's interest, bits of humor occasionally were included. These exercises were not constructed to conform to any quantitative criteria, except that each of the first fifteen exercises were checked to determine if all the alphabetic letters were included in them. It was also found that the digraphs given by Rowe as having a frequency of 20 or more in the 1,000 most frequently used words were included in each of the first fifteen exercises. Seventy per cent of the words in these exercises, as a group, were among Horn's 1,000 most frequently used words, and the remaining 30 per cent were composed of derivatives or less frequently used words. Samples of the other eighty-five exercises indicated that these same proportions of common and less common words obtained in them.

None of these aspects of the copy-material exercises, physical setup on the page, qualitative features of the content, or quantitative features of the words used was believed to favor either the experimental or the control students.

CLASS PROCEDURES

The class procedures may be grouped into three learning periods of approximately twenty-five lessons each and totaling seventy-five lessons, the net

classes (see the lesson plans in Appendix I; cf. n. 6 below and chap. iii, n. 16).

⁴ The detailed lesson plans for the experimental method are given below in Appendix I; those for the control method, in Appendix II.

number of lessons in a semester after the holidays and other class periods which are missed have been deducted. Table 1 gives a schedule of these lessons.

ORIENTATION

The orientation of both groups to machine manipulations, touch system of fingering, and location of keys on the key-

and paragraphs, lengthening to exercises of approximately 1,000 strokes in Lesson 9, are included. The basic writing interval, two minutes in Lessons 1 and 2, one-half and one minute in Lessons 3-6, is increased to five minutes in Lesson 7 and to ten minutes in Lesson 9.

While the orientation for both groups is the same in the first two lessons, dif-

TABLE 1

Experimental Group	Lessons	Control Group
Orientation		Orientation
Introduction to touch type-writing	1- 2	Introduction to touch type-writing
100-stroke speed on short writings	3- 8	Perfect accuracy on short writings
First Speed Drive	9-21	Main Emphasis on Accuracy
100-stroke speed for 10 minutes		Copies to be graded
Transition lessons	(18-21)	Some emphasis on speed
First Accuracy Drive	22-27	Continued Accuracy Emphasis
Maintaining speed while striving for accuracy		Maintaining accuracy while striving for speed
Second Speed Drive	28-38	Continued Accuracy Emphasis
150-stroke speed for 10 minutes		Copies to be graded
Transition lessons	(35-38)	Some emphasis on speed
Second Accuracy Drive	39-51	
Maintaining speed while striving for accuracy		
Accuracy Emphasis (Same lessons as Control Group)	52-75	Continued Accuracy Emphasis
		Copies to be graded
		Some emphasis on speed

board—all the elements required for typewriting serial copy—extends only through the first eight lessons. In the first four of these lessons the copy material is composed of simple directional charts printed above small units of words and phrases. They are planned for the student to learn the alphabetic-letter reaches through repeated use. In these lessons are frequent drills for finding the guide keys by touch. After Lesson 4 the directional charts are omitted, and the longer units of copy material, sentences

and paragraphs are placed on speed and accuracy from Lesson 3 on. The speed emphasis in the experimental classes is presented in the following manner:

a) The teacher demonstrates the sound of writing words at the 200-stroke speed while the students listen and then attempt to type at the same rate. Then the teacher demonstrates at the desired 100-stroke speed, and, following this, the students write for one-half-minute and one-minute intervals.

b) The students are gradually introduced to serial writing so that in Lesson 7 they are directed to write for five minutes. They are asked

to write as rapidly as they can, disregarding any and all typescript errors and expecting to be graded solely on speed.

The accuracy emphasis in the control classes is presented in the customary manner, as follows:

a) The teacher demonstrates the sound of writing words at 50-75 strokes per minute, emphasizing quick-strokings with equal intervals between strokes for relaxation and planning the next stroke. Then the students imitate the sound of the teacher's writing for one-half-minute and one-minute intervals.

b) The students are directed to write serial copy material for one-minute intervals, attending solely to accurate reaches and making a perfect copy. They are asked to make assigned copies until they are directed to do otherwise.⁵ These assigned copies are scored on accuracy only, with a limited number of errors permitted for an average grade. At all times the control students are directed to write only as fast as they can write accurately.

FIRST SPEED DRIVE OF EXPERIMENTAL STUDENTS

The first speed drive of the experimental students for the 100-stroke speed goal in writing serial copy for ten-minute intervals begins in Lesson 9. The drive provides frequent opportunities for the students to be timed for consecutive ten-minute intervals, from one to three such writings being scheduled for each lesson, dependent on the amount of time needed for other techniques. During the speed drive the students are motivated in the following ways:

a) Variety and novelty in copy material are introduced by the use of at least one new exercise in each lesson. For interest value, the thought content of each new exercise is called to the students' attention. Monotony of copy material is avoided by using each exercise only once or twice in a lesson and by repeating familiar exercises in a distributed order.

⁵ This procedure keeps the amount of practice time on exercises the same for both experimental and control students.

b) The feeling of security which springs from repeating familiar copy material is encouraged by repeating familiar exercises in subsequent lessons.

c) The speed goal is refreshed in the student's minds by having the teacher restate the goal simply and directly just before each ten-minute writing interval. It is made objective by the physical setup of the copy material, only one exercise of 1,000 strokes being placed on each text page. It is strengthened by the grading system⁶ which is based on class-quartile speed results, with no failing grades. The students calculate their own rates from the cumulated stroke-count in their texts, and the teacher verifies their calculations.

d) The fear of making errors is decreased greatly, if indeed not entirely eliminated, by having the teacher remind the students just before each writing interval that they should ignore any and all typescript errors.

e) Knowledge of their own results from lesson to lesson is assumed to be a positive force in the students' motivation. It is assumed that the students will be encouraged by their rising speed rates, even though these rates are less than 100 strokes, since no time limit is set when the student should attain this goal.

In this first speed drive the device of repeating short units of copy material (e.g., phrases and short sentences) is utilized for forcing speed. Starting in Lessons 16 and 17 and continuing through the transition lessons (18-21), the speed drive is intensified with three ten-minute writing intervals in each lesson. By directing those students who had attained the 100-stroke speed goal to begin reducing their error rates, it is hoped that the students who have not yet reached the goal would make a special effort to do so.

FIRST ACCURACY DRIVE OF EXPERIMENTAL STUDENTS

In the first accuracy drive of the experimental students, from Lessons 22 to 27, the students are asked to reduce the

⁶ The grading scale used in the Experimental-A Class was an absolute scale (see above, n. 3).

error rate gradually as they maintain their top speed levels. In the main, this drive was implemented by three devices:

a) Having the students mark their own errors on ten-minute writings and determine their error rates.

b) Having them practice in repetition the sections in which errors are most frequent.

c) Having them strive to make perfect or nearly perfect copies of small units of copy material (e.g., one paragraph of 250 strokes). Two procedures are used. The first focuses attention on setting up neat copy on half-sheets, and the second directs the students to repeat the paragraph twice and to determine the error rate per paragraph for the three writings.

In the accuracy drive, as in the speed drive, the students are motivated in a number of ways:

a) Variety and novelty in copy material, interest value in new exercises, and avoidance of monotony are sought here in the same manner as previously.

b) The accuracy goal is refreshed in the students' minds by having the teachers restate the goal simply and directly just before each ten-minute writing. It is strengthened by the grading system. Although the grading system is based on the class-quartile results, it is assumed that the number of errors permitted for the average grade will constantly decrease, since the average errors of the class will decrease.

c) The detrimental nervous tensions in the ten-minute writings are decreased by directing the students not to expect perfection immediately and to reduce their error rates gradually. It is not anticipated that writing at the previous speed level would offer any cause for tenseness. There seems to be less likelihood for surplus tensions in the repetitive practices, particularly when the size of the copy material is reduced from the usual practice.

d) Knowledge of their own results from lesson to lesson is assumed to be a positive force in the students' motivation. It is assumed that the students will be encouraged by their decreasing error rates, likely to diminish very suddenly at first, and will not be discouraged by persistent rates which are relatively high, since no time limit is set when the students should entirely eliminate their errors. It is also

assumed that the error rates on the shorter writings might be less and hence a source of encouragement.

MAIN EMPHASIS ON ACCURACY FOR CONTROL STUDENTS

Simultaneous with the experimental first speed and accuracy drives, the main emphasis in the control classes is on accuracy of typescript. Although the control students spent the same amount of practice time on the various units of copy material, they use the copy material more intensively, often repeating a section of the exercise several times before continuing to the next section. In order to permit these students to practice on the later sections of the exercises, likely not reached in the first practice, the exercises are repeated in a distributed order in later lessons.

The accuracy emphasis is implemented by the following devices:

a) Having the students strive to make perfect or nearly perfect copies of small units of copy material (e.g., one lettered section of an exercise—one paragraph of 250 strokes). The procedure focuses attention on setting up neat copy on half-sheets. Each copy is to be handed in and graded according to a strict error scale.

b) Having the students become conscious of their errors by marking them in their copies and making lists of the more common ones.

c) Having the students periodically do various kinds of corrective practice on their common errors. Difficult parts of the new exercise are sometimes practiced before the exercise itself is introduced.

d) Having the teacher confer individually with students who had special difficulties in keeping the error rates low.

e) Having the students write for ten-minute intervals in alternate lessons and grade their papers in terms of errors only until Lesson 15, after which time the 50-stroke error penalty is used.

During this accuracy emphasis the students are motivated in the following ways:

a) Variety and novelty in copy material, interest value in new exercises, and avoidance of monotony are sought in the same manner as in the experimental classes, the same schedule of exercises being used for both.

b) The accuracy goal is refreshed in the students' minds by having the teacher restate the goal simply and directly just before each ten-minute writing. It is strengthened by the grading system. Although the grading system for the ten-minute writings permits only a few errors, the students might offset possible low grades on these writings by higher grades on the small copies, which may be repeated a number of times. In these ten-minute writings only the errors are graded at first; hence the students are free to attend only to accuracy.

c) The detrimental nervous tensions in the ten-minute writings are decreased by permitting the students to have as many as eight errors for an average grade and to be free from any speed requirement. It is not anticipated that writing for accurate typescript would offer any cause for tenseness. The students write four ten-minute writings from Lessons 9 to 15 before any mention is made of speed. There seems to be less likelihood for surplus tensions in the small-copy practice, particularly when the copy may be repeated a number of times.

d) Knowledge of their results from lesson to lesson is assumed to be a positive force in the students' motivation. It is assumed that the students will be encouraged by their grades on the small copies, even though they make few of them, since no time limit is set when the students should complete all the copies assigned. It is also assumed that all the students could make an average grade in the ten-minute writings a part of the time.

SECOND SPEED AND ACCURACY DRIVES OF EXPERIMENTAL STUDENTS

The second speed drive of the experimental students, with the goal raised to 150 strokes, is carried on in the same manner as the first. It begins in Lesson 28 and is intensified from Lessons 35 to 38. The second accuracy drive is also similar to the first. It begins in Lesson 39 and continues intensively for ten lessons; in fact, the main emphasis is on accuracy for the remainder of the semes-

ter. After Lesson 51 the lesson plans of the experimental classes are the same as those for the control.⁷

CONTINUED ACCURACY EMPHASIS FOR CONTROL STUDENTS

In the main, the accuracy emphasis for the control students is continued with only minor variations in the devices used for the sake of variety and to maintain the students' interest in the course. As time goes on, the grading of the ten-minute writings on the basis of net speed, after Lesson 15, is assumed to give an increasing emphasis on speed, even though the main emphasis still remains on accuracy. This procedure is similar to that commonly used in the traditional accuracy emphasis, except, in the latter, speed tests would not be given so frequently. It is assumed that the experience of taking so many ten-minute tests (in the alternate lessons from Lessons 9 to 75) would favor the speed attainments of the control classes; however, the major function of the alternate lesson tests is to get frequent data on the lesson-by-lesson progress of both the control and the experimental classes.

TESTING PROGRAM

The testing program consists of one ten-minute writing in the alternate lessons from 9 to 75, except Lessons 53, 57, 61, 65, and 69. The plan of testing for each lesson is as follows: (1) twenty minutes of other practice; (2) a change of activity for three to five minutes; (3) the ten-minute writing; and (4) subsequent class activity.

The test copy material⁸ is similar to

⁷ The experiment in Schools B and C was continued through seventy-five lessons; in School D, through seventy-three lessons (see n. 2 above).

⁸ See Appendix IV.

the regular 1,000- and 1,500-stroke exercises. The tests were selected by two experienced typewriting teachers from tests previously given to their classes with fairly constant results. In other words, they were selected with common-sense estimates of fairness in difficulty and not constructed around quantitative measurements, such as length of words, length of sentences, number of high-frequency words, capital letters, and figures, since it is assumed that no reliable quantitative criteria are known.

The tests are scored in terms of strokes by counting the actual number of machine manipulations executed, including the key stroke, shift key, line lever, tabulator, and backspacer, each

of which was counted as one stroke; omissions or repetitions of strokes are subtracted or added on this same basis. The tests are scored in terms of stroke-errors, not word-errors. In counting the errors, the omission or repetition of any stroke or group of strokes is counted as one error; a double-letter error, such as "tiik" for "took," is counted as one error; and the transposition of adjacent letters, such as *ie* for *ei* is counted as one error, but if another letter intervened, as in "mane" for "name," it is counted as two errors. The raw scores on each writing are in average gross strokes per minute and average stroke-errors per minute, the latter being reduced to number of errors per 100 strokes written.

CHAPTER III

THE RESULTS AND THE INTERPRETATION

INTRODUCTION

THE data of this experiment consist of stroke and error scores of 186 beginning typewriting students in four experimental and four control classes. They are the results of ten-minute writings on new serial copy material, one writing in most of the alternate lessons from 9 to 73, except the results of the Experimental- and Control-A classes (38 students each), which continue through Lesson 51 only. The stroke or speed results are in terms of average gross strokes per minute, and the error or accuracy results are in terms of average stroke-errors per 100 strokes.

The presentation of the results, consisting of frequent stroke and error scores, is simplified by combining the Experimental B, C, and D classes, the

data of which are fundamentally similar in character, and by combining the Control B, C, and D classes, whose data likewise are similar. The resulting Experimental- and Control-BCD groups contain 55 students each. A separate treatment of the results of the A classes is required because of the dissimilar character of the data from the Experimental-A Class. Since the combined data of the B, C, and D classes extend over the entire semester of 73 lessons, they are treated in the main discussion, while the data of the A classes, for 51 lessons only, are given a parallel treatment in the footnotes. In the interpretation, however, the data from all eight classes are treated in one discussion.

The stroke scores of the Experimental-BCD Group students were av-

eraged to determine the group mean strokes for each ten-minute writing in Lessons 9-73, and those of the Control-BCD Group students were treated likewise. The group mean error scores of both BCD groups were determined in the same manner.¹ The data are discussed as follows: (1) The Control-BCD Group mean strokes and errors curves are described in a summary fashion, since these curves are used in detail later for contrasting with the Experimental-BCD Group curves. (2) The Experimental-BCD Group curves are presented chronologically in three learning periods of approximately twenty-five lessons each and compared with the Control-BCD Group curves, as well as with the supplementary Experimental-A Class and the Control-A Class results. (3) The typical experimental group speed and accuracy curves are illustrated by individual student curves, and the typical control group speed and accuracy curves are likewise illustrated. In addition, curves of atypical students are presented. (4) The results of the experiment as a whole are interpreted in terms of three hypotheses around which this study centers.

THE CRITERIA CONTROL-BCD GROUP RESULTS

The Control-BCD Group mean gross strokes curve, as presented in Figure 1 and according to the data given in Table 2, starts at the 40-stroke level in Lesson 9, the earliest recorded data,² rises in almost a straight line to about 80 in Lesson 27 and to 120 in Lesson 51, and then goes up somewhat more gradually to 140

in Lesson 73. The average increase per lesson for the three learning periods of approximately twenty-five lessons each are 2.1 strokes (for the partial period from Lessons 9 to 27), 1.6 (from Lessons 29 to 51), and 1.0 (from Lessons 53 to 73). The periodic jogs in this speed curve are minor, there being only two drops of as much as 9 strokes, and these may be due to the difficulty of the copy material used in those lessons.³

The Control-BCD Group mean errors curve, also presented in Figure 1 with the data in Table 2, starts at the three-error level in Lesson 9, descends sharply to about two errors in Lesson 13, and then remains at approximately this level.

The relationship between the Control-BCD Group mean strokes curve and the Control-BCD Group mean errors curve is not close, since the former rises gradually as the latter remains at approximately one level. Correlations of student stroke scores plotted against error scores for two series of lessons resulted in coefficients which approached zero.⁴

THE EXPERIMENTAL-BCD GROUP RESULTS

a) First learning period.—As early as Lesson 9 the Experimental-BCD Group mean speed curve is significantly higher than that of the Control-BCD Group by about 20 strokes, or 47 per cent; with this superior speed, however, the ac-

³ Both groups and both classes behave similarly in these two lessons, 47 and 63.

⁴ The correlations were first made in terms of errors per 100 strokes and then in terms of errors per minute, and the results were approximately the same. For a discussion of a possible freak correlation in data of this kind see Luton Ackerson, *A Correlational Analysis of Proficiency in Typing* ("Archives of Psychology," No. 82 [New York, February, 1926]), pp. 66-67.

¹ The results of the Experimental- and Control-A classes underwent the same treatment.

² Lesson 9 is early in comparison to data of previous investigators, whose data do not begin until Lesson 20.

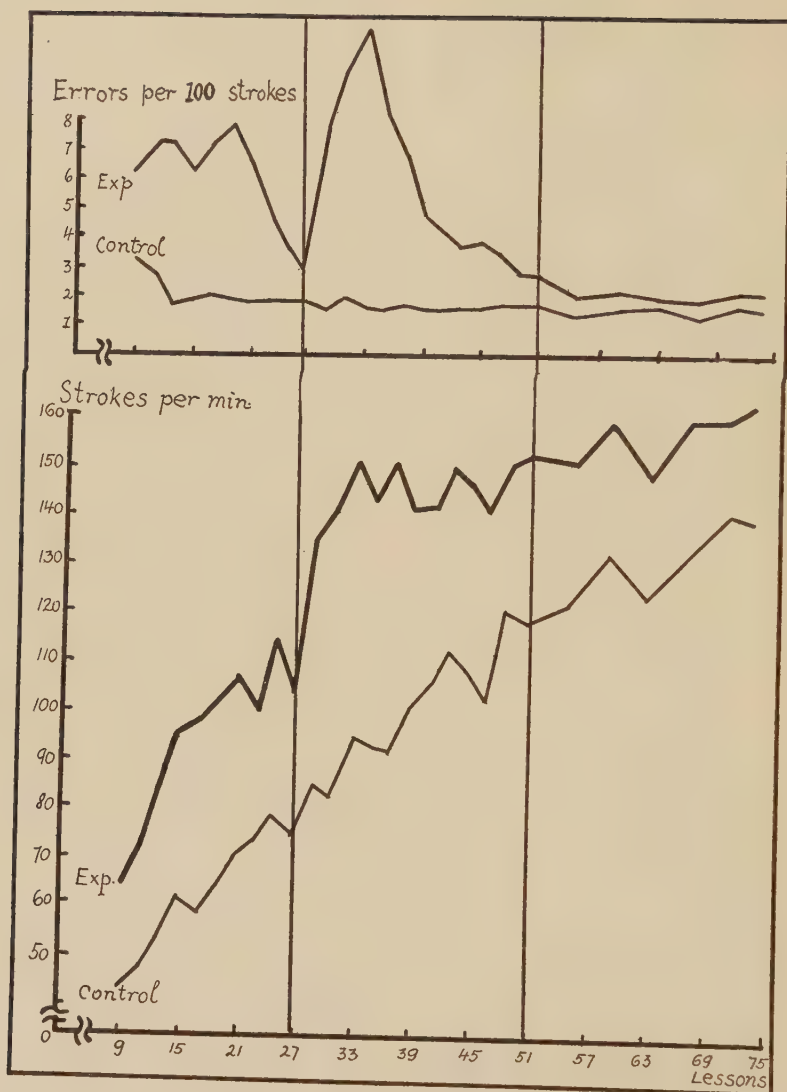


FIG. 1.—Mean strokes and error curves for Experimental-BCD and Control-BCD groups (55 students each) in elementary typewriting, ten-minute writings, Lessons 9-73.

TABLE 2

MEAN GROSS STROKES AND MEAN STROKE-ERRORS PER 100 STROKES OF EXPERIMENTAL-BCD AND CONTROL-BCD GROUPS (55 STUDENTS EACH) OF ELEMENTARY TYPEWRITING STUDENTS, WITH PERCENTAGE RELATIONS, IN TEN-MINUTE WRITINGS, LESSONS 9-73

	LESSON						
	9	11	13	15	17	19	21
Exp.-BCD No.*	52.0	49.0	53.0	50.0	50.0	53.0	53.0
Mean strokes	63.0	73.0	84.0	95.0	98.0	102.0	106.0
Mean errors	6.1	7.2	7.2	6.4	7.4	7.9	6.6
Con.-BCD No.*	51.0	44.0	49.0	48.0	54.0	52.0	52.0
Mean strokes	43.0	48.0	53.0	61.0	59.0	65.0	70.0
Mean errors	3.4	2.7	1.7	1.9	2.0	1.9	1.8
Exp./Con. strokes	147%	152%	158%	156%	166%	157%	151%
Exp./Con. errors	179%	267%	424%	337%	370%	416%	367%
	23	25	27	29	31	33	35
Exp.-BCD No.*	54.0	49.0	53.0	53.0	51.0	53.0	51.0
Mean strokes	100.0	115.0	103.0	135.0	141.0	151.0	143.0
Mean errors	4.6	3.8	2.8	7.7	9.7	11.3	8.1
Con.-BCD No.*	51.0	50.0	48.0	49.0	51.0	53.0	49.0
Mean strokes	74.0	79.0	75.0	85.0	82.0	94.0	93.0
Mean errors	1.8	1.8	1.9	1.6	2.0	1.7	1.5
Exp./Con. strokes	135%	146%	137%	159%	172%	161%	154%
Exp./Con. errors	256%	211%	147%	481%	485%	665%	540%
	37	39	41	43	45	47	49
Exp.-BCD No.*	48.0	53.0	52.0	51.0	49.0	53.0	50.0
Mean strokes	150.0	141.0	142.0	151.0	146.0	141.0	151.0
Mean errors	7.0	4.7	4.3	3.7	3.9	3.5	2.9
Con.-BCD No.*	49.0	48.0	46.0	48.0	52.0	49.0	53.0
Mean strokes	96.0	103.0	107.0	112.0	109.0	103.0	121.0
Mean errors	1.7	1.6	1.6	1.6	1.6	1.9	1.7
Exp./Con. strokes	156%	137%	133%	135%	134%	137%	125%
Exp./Con. errors	412%	294%	269%	231%	244%	184%	171%
	51	55	59	63	67	71	73
Exp.-BCD No.*	54.0	54.0	54.0	50.0	49.0	51.0	52.0
Mean strokes	153.0	152.0	160.0	146.0	159.0	161.0	164.0
Mean errors	2.7	2.1	2.2	2.0	2.0	2.1	2.0
Con.-BCD No.*	47.0	45.0	46.0	48.0	43.0	47.0	44.0
Mean strokes	119.0	123.0	133.0	124.0	133.0	141.0	141.0
Mean errors	1.9	1.5	1.8	1.7	1.4	1.8	1.7
Exp./Con. strokes	129%	124%	120%	118%	120%	114%	116%
Exp./Con. errors	142%	140%	122%	118%	143%	117%	118%

* Number of students in group in given lesson.

curacy of the former is significantly inferior to that of the latter, the experimental error curve being higher by 79 per cent (see Fig. 1 for the graphical presentation of these curves and Fig. 2 for their percentage relationships; and see

According to a .05 fiducial standard of significance, arbitrarily adopted for this study, the differences in both comparisons are significant.⁵

From Lessons 9 to 15, the experimental speed curve rises more sharply than

TABLE 3

STATISTICAL DATA RELATING MEAN STROKES AND MEAN ERRORS OF ELEMENTARY TYPEWRITING STUDENTS (IN TEN-MINUTE WRITINGS, WITH GROSS STROKES PER MINUTE AND STROKE-ERRORS PER 100 STROKES)

Lesson	Group or Class	No. of Students	Mean Strokes	S.D.	Difference	$\frac{D}{\sigma_D}$ *	Level of Significance†	Mean Errors	S.D.	Difference	$\frac{D}{\sigma_D}$ *	Level of Significance†
9.....	Exper. BCD	52	63	17	20	7.0	.001	6.1	5.0	2.7	3.0	.001
	Con. BCD	51	43	9				3.4	3.9			
27.....	Exper. BCD	53	103	29	28	6.0	.001	2.8	1.8	0.9	2.2	.01
	Con. BCD	48	75	21				1.9	2.2			
51.....	Exper. BCD	54	153	31	34	6.0	.001	2.7	2.6	0.8	2.7	.004
	Con. BCD	47	119	27				1.9	1.4			
63.....	Exper. BCD	50	146	27	22	4.0	.001	2.0	1.6	0.3	1.0	.16
	Con. BCD	48	124	28				1.7	1.3			
71.....	Exper. BCD	51	161	30	20	3.0	.001	2.1	1.8	0.3	0.8	.21
	Con. BCD	47	141	28				1.8	1.8			
73.....	Exper. BCD	52	164	32	23	4.0	.001	2.0	1.7	0.3	0.8	.21
	Con. BCD	44	141	28				1.7	1.9			
9.....	Exper. A	38	55	19	11	4.0	.001	4.4	3.3	1.8	2.6	.005
	Con. A	38	44	11				2.6	2.9			
27.....	Exper. A	33	88	24	9	2.0	.02	2.2	1.5	0.4	1.0	.16
	Con. A	36	79	22				1.8	1.4			
51.....	Exper. A	37	120	28	— 6	0.9	.18	1.6	1.6	0.5	1.7	.04
	Con. A	32	126	28				1.1	0.7			
9.....	Exper. BCD	52	63	17	8	2.0	.02	6.1	5.0	1.7	1.9	.03
	Exper. A	38	55	19				4.4	3.3			
27.....	Exper. BCD	53	103	29	15	3.0	.01	2.8	1.8	0.6	1.5	.07
	Exper. A	33	88	24				2.2	1.5			
51.....	Exper. BCD	54	153	31	33	5.0	.001	2.7	2.6	1.1	2.8	.003
	Exper. A	37	120	28				1.6	1.6			

$$* \sigma_D = \sigma^2_{M1} + \sigma^2_{M2} \text{ and } \sigma_M = \frac{\text{S.D.}}{\sqrt{N}}.$$

† The 0.5 fiducial level is arbitrarily adopted in this study for the significance criterion. Results more significant than .01 level are carried out to three places.

Table 2 for the numerical data and Table 3 for the statistical comparisons). Specifically, at Lesson 9:

The Experimental-BCD speed of 63 strokes (S.D. 17) is 20 strokes (47 per cent) higher than the Control-BCD speed of 43 strokes (S.D. 9).

The Experimental-BCD errors of 6.1 (S.D. 5.0) are 2.7 errors (79 per cent) higher than the Control-BCD errors of 3.4 (S.D. 3.9).

the control, the lesson increments being 5 compared to 3 strokes, respectively,

⁵ Comparable data for the Experimental-A Class: The comparisons of the Experimental-A Class speed and error results to those of the Control-A Class are the same as the Experimental-BCD Group—Control-BCD Group comparisons (see Table 3 for numerical data and Fig. 3 for graphical presentations). An equally pertinent comparison to note in Lesson 9 is the relation between the results

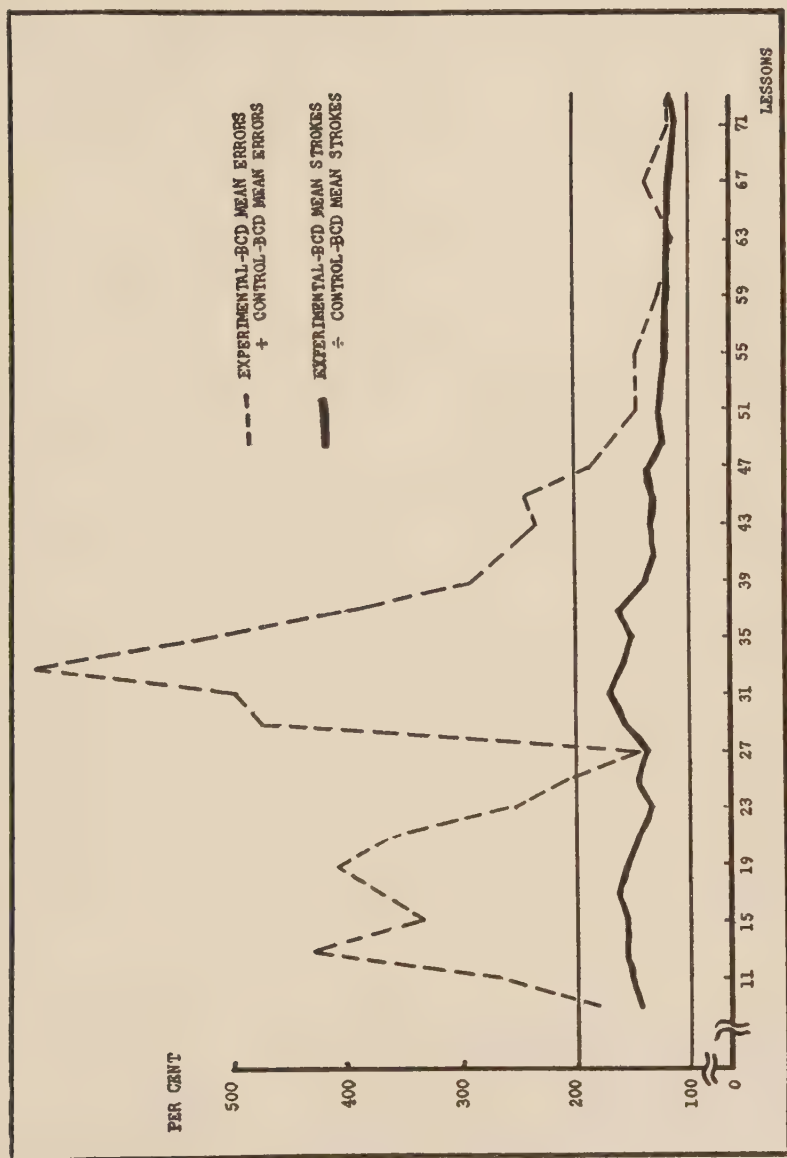


FIG. 2.—Mean strokes and errors curves for Experimental-BCD and Control-BCD groups (55 students each) in elementary typewriting, ten-minute writings, Lessons 9-73, expressed in per cent of Control-BCD Group data. (Solid line represents mean strokes; broken line, mean errors.)

and hence the initial experimental lead is increased; from Lessons 17 to 21, the experimental speed curve rises less sharply, falling back to about the same rate of rise as that of the control group. (Of the individual scores which are component to this group curve, 40 per cent of the experimental students are at the 100-stroke speed goal or above by Lesson 15; 13 per cent more reach it by Lesson 17; and 16 per cent more by Lesson 21.) During these lessons the experimental error curve varies little from Lessons 9 to 15, fluctuating between 6 and 7 errors; rises to a peak for this period—7.9 errors—in Lesson 19; and then suddenly turns downward in Lesson 21. The control error curve, as stated previously, drops at first and then remains at approximately the one level.

From Lessons 23 to 27, the experimental speed curve drops temporarily from the 106-stroke level reached in Lesson 21, an insignificant drop of 6 strokes in Lesson 23,⁶ and then rises 9 strokes above the Lesson 21 level, reaching 115 in Lesson 25; it drops below the Lesson 21 level for the second time in Lesson 27—an insignificant drop of 3 strokes to 103. Simultaneously, the control speed curve continues to rise at an

average increase per lesson of approximately 2 strokes. During these lessons the experimental error curve continues to fall sharply, getting down to 2.8 errors in Lesson 27, while the control error curve remains at approximately the one level.

The terminal comparisons for this learning period, in Lesson 27, show that the experimental speed is superior to the control by a lead in absolute strokes (about 28) which is larger than that of Lesson 9 (20 strokes).⁷ With this superior speed, however, the experimental accuracy is not yet equivalent to that of the control group, although it has recovered from an inferiority of 316 per cent in Lesson 19 to only 47 per cent in Lesson 27, compared to a speed superiority reduction from the peak of this period, 66 per cent in Lesson 17, to 37 per cent in Lesson 27. Specifically:

The Experimental-BCD speed of 103 strokes (S.D. 29) is 28 strokes (37 per cent) higher than the Control-BCD speed of 75 strokes (S.D. 21).

The Experimental-BCD errors of 2.8 (S.D. 1.8) are 0.9 error (47 per cent) higher than the Control-BCD errors of 1.9 (S.D. 2.2).

According to a .05 fiducial standard of significance, both differences are significant (see Table 3).⁸

⁷ The 28-stroke lead is a lead of 37 per cent, while the 20-stroke lead is a lead of 47 per cent.

⁸ Comparable data for the Experimental-A Class: This experimental class maintains a significantly higher speed than its control class, both rising at about the same slant, until Lesson 21; after this time, both curves drop, recovering partly by Lesson 27, at which time the experimental speed is significantly higher than the control (see Fig. 3 and Table 3). The experimental-class error curve drops, for the most part, gradually from Lessons 13 to 19 and sharply from Lessons 19 to 27, while the control-class error curve is at approximately one level from Lesson 13 on, with a slight rise in Lesson 23, at which level it remained through Lesson 27. At Lesson 27 the experimental-class error curve is not significantly different from its control-class error curve. Specifically, at Lesson 27:

The Experimental-A speed of 88 strokes (S.D.

of the Experimental-A Class as compared to the Experimental-BCD Group. The Experimental-A Class speed is significantly lower than the Experimental-BCD Group speed, and the error rate of the former is also significantly lower than the error rate of the latter. Specifically, at Lesson 9:

The Experimental-A speed of 55 strokes (S.D. 19) is 8 strokes lower than the Experimental-BCD speed of 63 strokes (S.D. 17).

The Experimental-A errors of 4.4 (S.D. 3.3) are 1.7 errors lower than the Experimental-BCD errors of 6.1 (S.D. 5.0).

⁶ In Lesson 21 the 53 students present have a group strokes mean of 106 (S.D. 28), and in Lesson 23 the 54 students present have a mean of 100 (S.D. 27). The difference of 6 strokes does not meet the .05 fiducial level and is not considered significant, meeting only the .12 fiducial level.

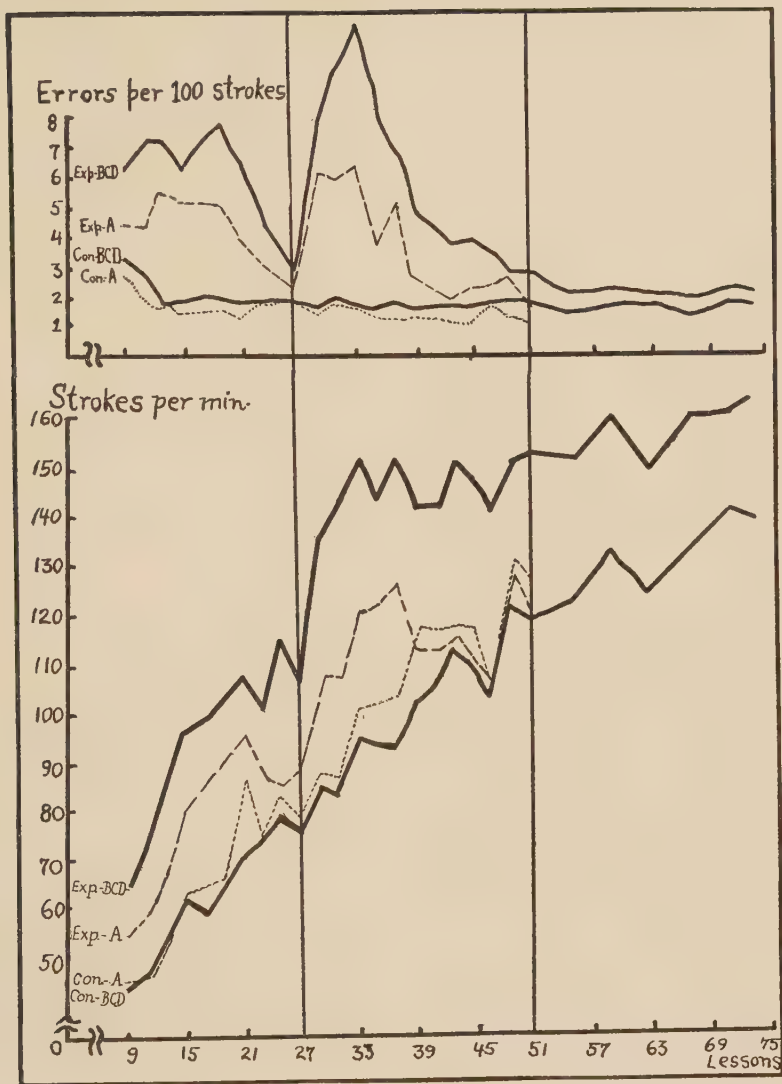


FIG. 3.—Mean strokes and error curves for Experimental-BCD and Control-BCD groups (55 students each) and for Experimental-A and Control-A classes (38 students each) in elementary typewriting, ten-minute writings, Lessons 9-73.

The relationship between the experimental-group mean strokes curve and the mean errors curve for Lessons 9–15 is direct, since both curves tend to rise; for Lessons 19–27 there is no relationship indicated. Correlations of the student stroke scores plotted against error scores for these two series of lessons yield coefficients of $+.26$ and $+.07$, respectively.⁹

At Lesson 27 the speed and accuracy relationship between the scores of these two groups may be considered in another way, such as that presented in the scattergram of the student strokes plotted against errors (see Fig. 4). By actual count of the plotted X's representing the experimental students' results, 48 students, or 91 per cent of the 53 present on that day, have speeds which are

24) is 9 strokes higher than the Control-A speed of 79 strokes (S.D. 22). This difference meets the .05 fiducial level and is considered significant.

The Experimental-A errors of 2.2 (S.D. 1.5) are 0.4 error higher than the Control-A errors of 1.8 (S.D. 1.4). This difference does not meet the .05 fiducial level, meeting only the .16 fiducial level, and is not considered significant.

In noting the equally important relationships here, the relation between the Experimental-A Class and the Experimental-BCD Group, it will be seen from Fig. 3 that this class speed curve runs at a lower level from Lessons 9 to 21 than the group but that it is almost parallel.

From Lessons 21 to 27 this class speed drops to a level significantly lower, the specific comparisons being repeated below:

Lesson	Class	No.*	Mean Strokes	S.D.	Diff.	$\frac{D}{\sigma_D}$	Level of Significance
21	Exper.-A	31	103	29	17	2.4	.010
23	Exper.-A	38	86	27			
21	Exper.-A	31	103	29	18	2.6	.005
25	Exper.-A	37	85	26			

* Number of students in group in given lesson.

At Lesson 27 the Experimental-A Class speed is not only significantly lower than that of the Experimental-BCD Group but is proportionally lower than it is at Lesson 9 (see Fig. 3 and Table 3).

⁹ Figures in terms of errors per minute (see above, n. 4).

higher than the control median speed, or higher than the speeds of 50 per cent of the control students. If these students with the higher speed also had equivalent accuracy, the superiority of the experimental group could be asserted with-

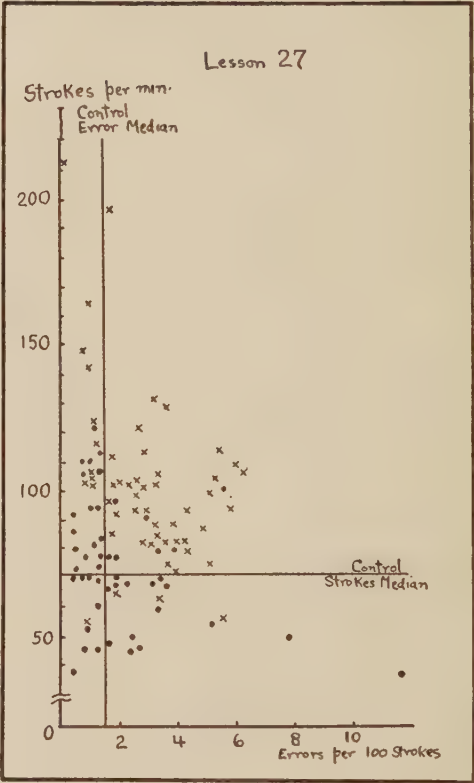


FIG. 4.—Scattergram of strokes and errors rates of 55 Experimental-BCD Group students (X's) and of 55 Control-BCD Group students (dots) in a ten-minute writing, Lesson 27, elementary typewriting. Control group medians are indicated.

out qualification; however, such is not the case at this stage of the learning process. Only 10 of these students, 19 per cent of the 53, meet both criteria, compared to 17 control students, 35 per cent of the 48 present during this lesson.

b) *Second learning period.*—During the second learning period the patterns of the speed and accuracy curves of the two groups repeat in the main those of the first learning period. From Lessons

29 to 33, in response to the second speed drive, the Experimental-BCD Group speed curve rises very sharply, going up from 103 strokes at Lesson 27 to beyond 150 strokes at Lesson 33. The lesson increment is 8 strokes, compared to 5 strokes of the first speed drive and compared to 3 for the control group. (Of the component individual scores making up the experimental group curve, 11 per cent were at the 150-stroke speed goal during the previous learning period and 46 per cent more reach it by Lesson 33.) The experimental lead in speed is highest at Lesson 31, being 72 per cent; and next highest at Lesson 33, being 61 per cent. During these lessons the experimental error curve makes a sharp upward rise, going from 2.8 errors at Lesson 27 to the peak high of 11.3 errors at Lesson 33.

From Lessons 37 to 51, the second accuracy emphasis (Lessons 35-38 being transitional, in which only a part of the students were directed to shift to accuracy), the experimental speed curve drops temporarily from the 150-stroke level of Lesson 37, lowering 9 strokes at Lesson 39 (a difference which meets a .07 fiducial level of significance, but not .05),¹⁰ remaining at 142 at Lesson 41; it rises back to 151 at Lesson 43.¹¹ During these lessons the experimental error curve falls sharply from 11.3 errors, the peak of this period, at Lesson 33, to less than 5.0 at Lesson 39, to less than 4.0 at Lesson 43, and to about 3.0 at Lesson 49. Simultaneously, as stated previously,

¹⁰ The data are as follows:

Lesson	Group	No.	Mean Strokes	S.D.	Diff.	$\frac{D}{\sigma_D}$	Level of Significance
37...	Exper.-BCD	48	150	29	9	1.5	.07
39...	Exper.-BCD	53	141	27			

¹¹ The subsequent drop to 141 strokes at Lesson 47 is likely due to difficult copy materials (see above, n. 3).

the control speed curve rises gradually from about 80 strokes at Lesson 27 to about 120 at Lesson 51, and the error curve remains at about the two-error level.¹²

The terminal comparisons for this learning period, at Lesson 51, show that the experimental speed is superior to the control speed by a lead in absolute strokes which is still larger than at Lessons 9 and 27, now being about 34 strokes.¹³ With this superior speed, however, the experimental accuracy is still not yet equivalent to that of the control group, although it has recovered from a peak inferiority of 565 per cent at Lesson 33 to only 42 per cent at Lesson 51, compared to a speed superiority reduction from the peak of this period, 72 per cent at Lesson 31, to 29 per cent at Lesson 51. Specifically:

The Experimental-BCD speed of 153 strokes (S.D. 31) is 34 strokes (29 per cent) higher than the Control-BCD speed of 119 strokes (S.D. 27).

The Experimental-BCD errors of 2.7 (S.D. 2.6) are 0.8 error (42 per cent) higher than the Control-BCD errors of 1.9 (S.D. 1.4).

According to a .05 fiducial standard of significance, both differences are significant (see Table 3).¹⁴

¹² The lowest is 1.5 at Lesson 35.

¹³ This 34-stroke lead is a lead of 29 per cent (see above, n. 7).

¹⁴ Comparable data for the Experimental-A Class: From Lessons 27 to 33 this experimental-class speed curve rises, almost parallel in slant to the control-class speed curve and higher (see Fig. 3). From Lesson 37, however, it drops to a significantly lower level, to 112 strokes:

Lesson	Class	No.	Mean Strokes	S.D.	Diff.	$\frac{D}{\sigma_D}$	Level of Significance
37.....	Exper.-A	34	127	26			
39.....	Exper.-A	38	112	29	15	2.5	.01

This drop can hardly be called a temporary drop, since the speed curve recovers the former level only in Lesson 49. The accompanying error curve rises

The relationship between the experimental group mean strokes curve and the mean errors curve for Lessons 29 to 33 is direct, since both curves rise sharply; it is not close from Lessons 35 to 51, since the strokes curve tends to waver between two given levels, while the errors curve decreases sharply at first and then more gradually. Correlations of the student strokes scores plotted against errors scores for the speed-drive lessons including the transition lessons, 29 to 37, and for the accuracy lessons, 43 to 51, yield coefficients of $+0.03$ and $+0.28$, respectively.¹⁵

At Lesson 51 the speed and accuracy relationship between the scores of these two groups may be considered in a scattergram of strokes plotted against errors, such as presented in Figure 5. By actual count of the plotted X's representing the experimental students' results, 49 students, or 91 per cent of the 54 present at

sharply from 2.2 at Lesson 27 to 6.2 at Lesson 29 and remains at approximately one level until it turns downward at Lesson 35. At Lesson 51 the experimental-class speed is slightly less—not significantly so—than the control-class speed, and the experimental-class error rate is significantly inferior to that of the control class.

The Experimental-A speed of 120 strokes (S.D. 28) is 6 strokes less than the Control-A speed of 126 strokes (S.D. 28). This difference meets only the .18 fiducial level and is not considered significant.

The Experimental-A errors of 1.6 (S.D. 1.6) are 0.5 error higher than the Control-A errors of 1.1 (S.D. 0.7). This difference meets the .04 fiducial level and is considered significant.

In noting the relation between the Experimental-A Class and the Experimental-BCD Group: from Lessons 27 to 33, the experimental-class speed curve rises almost parallel to that of the group, but at a lower level; and the class errors peak is not as high as that of the group. At the end of this period, Lesson 51, the experimental-class speed is about 33 strokes lower, significantly so, than that of the group, but the experimental-class errors are significantly lower than those of the group (see Table 3).

The Experimental-A and Control-A Class results end with Lesson 51.

¹⁵ Figured in terms of errors per minute (see n. 4 above).

that lesson, have speeds which are higher than the control median speed, or higher than the speed of 50 per cent of the control students. If these students with the higher speed also had equivalent accuracy, the superiority of the experimental group could be asserted without qualification; however, as was stated for the results at Lesson 27, such is still not the case at this stage of the learning process. Only 13 of these students, 24 per cent of the 54, have accuracy rates which are equivalent to the control median, compared to 15 control students, 32 per cent of the 47 present. Up through this point the superiority of the experimental group as evidenced by speed results must be qualified by inferiority in accuracy.

c) *Third learning period.*—In the third learning period, while both groups are following the same lesson plans, daily involving new techniques and typewriting information, the two speed curves climb gradually upward, almost parallel to each other, and the two errors curves maintain the approximate previous levels respectively after Lesson 55, running almost parallel to each other. In the main, these two sets of curves tend to converge, the differences diminishing to some extent. The experimental group speed curve rises with a somewhat smaller lesson increment than the control group speed curve, about one-half stroke compared to one stroke, while the errors curve of the former tends to drop more than that of the latter. At Lesson 63 the experimental errors curve approximates the level of the control errors curve, being at 2.0 errors compared to 1.7, the difference of 0.3 not being significant. Simultaneously, the experimental speed curve, at 146 strokes, still retains a significant speed lead of 22 strokes.¹⁶

¹⁶ The Experimental-BCD errors of 2.0 (S.D. 1.6) are 0.3 error (18 per cent) higher than the

The terminal comparisons for this learning period, in Lesson 73, are similar to those in Lesson 63: the experimental speed curve is significantly superior to the control speed curve by a lead of 23 strokes, or 16 per cent, while the experimental errors curve approxi-

Specifically:

The Experimental-BCD speed of 164 strokes (S.D. .32) is higher by 23 strokes (16 per cent) than the Control-BCD speed of 141 strokes (S.D. .28).

The Experimental-BCD errors of 2.0 (S.D. 1.7) are 0.3 error (18 per cent) higher than the Control-BCD errors of 1.7 (S.D. 1.9).

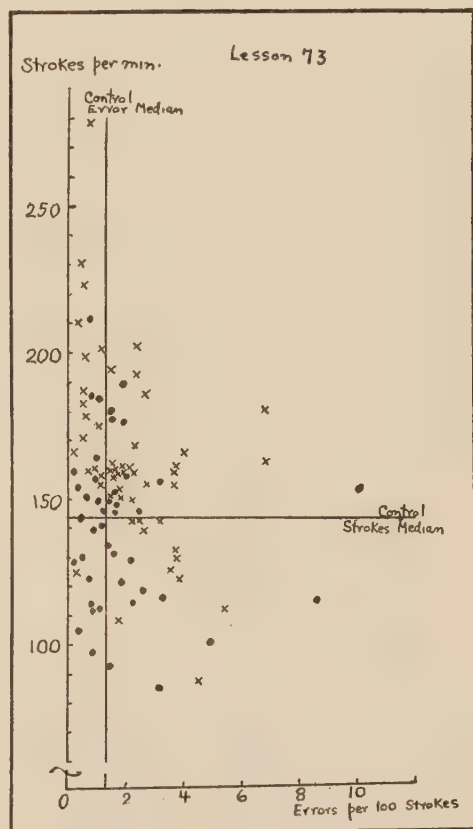
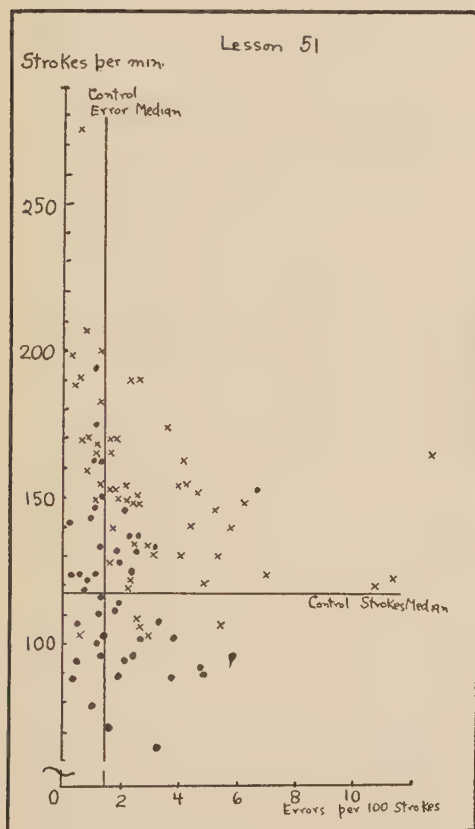


FIG. 5.—Scattergrams of strokes and errors rated of 55 Experimental-BCD Group students (X's) and of 55 Control-BCD Group students (dots) in ten-minute writings, Lessons 51 and 73, elementary typewriting. Control group medians are indicated.

mates the level of the control errors curve, with a difference of 0.3 error, or 18 per cent, which is not significant.

Control-BCD errors of 1.7 (S.D. 1.3), a difference which is not significant, meeting only the .16 fiducial level. Simultaneously, the Experimental-BCD speed of 146 strokes (S.D. .27) is significantly higher by 22 strokes (18 per cent) than the Control-BCD speed of 124 strokes (S.D. .28). Similar comparisons obtain at Lesson 71 (see Table 3).

According to the .05 fiducial standard of significance, arbitrarily adopted in this study, the difference in speed is significant, and the difference in accuracy is not significant, meeting only the .21 fiducial level.

A substantiation of these data is found in a consideration of the students' strokes plotted against errors, the com-

ponent scores of the group results, such as are presented in Figure 5. By count of the plotted X's representing the experimental students' results, 41 experimental students, or 79 per cent of the 52 present at Lesson 73, have speeds which are higher than the control median speed, or higher than the speeds of 50 per cent

TYPICAL SPEED AND ACCURACY CURVES

A number of speed and accuracy curves of individual experimental students follow closely the typical curves for the group. Illustrative of these are the curves shown in Figure 6. The typical experimental speed curve rises sharply to 100 strokes or more before leveling off for a few lessons; then it turns sharply upward again, rising to 150 strokes or more before leveling off for the second time; and in the remaining lessons it wavers but rises gradually. The accom-

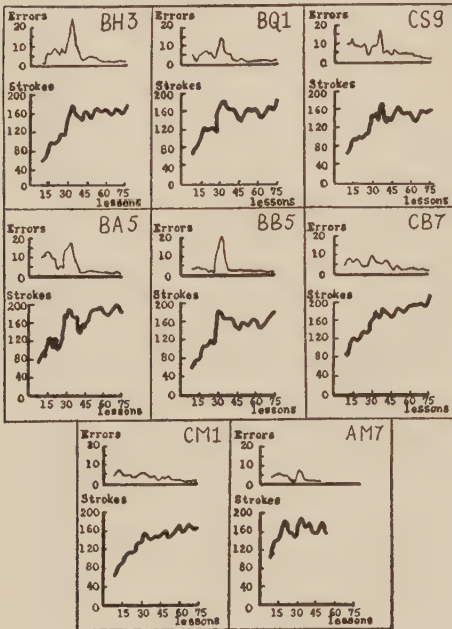


FIG. 6.—Speed and accuracy curves of eight typical experimental students. Speed is in terms of strokes per minute, and accuracy is in errors per 100 strokes. Writing intervals are for ten minutes.

of the control students. At this same time, 16 of these students, or 31 per cent of the 52, also have accuracy rates which are equivalent to the control median, compared to only 11 control students, 25 per cent of the 44 students present at this lesson, who meet both criteria. Hence the superiority of the experimental group in speed, as well as accuracy, may be asserted without qualification at the end of the semester of seventy-three lessons.

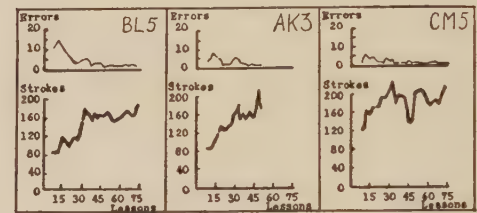


FIG. 7.—Speed and accuracy curves of three atypical experimental students atypical in errors. Speed is in terms of strokes per minute, and accuracy is in errors per 100 strokes. Writing intervals are for ten minutes.

panying typical experimental error curve starts at a fairly high level and rises slightly to a peak before turning downward to a fairly low level; then it again turns upward and rises sharply to a peak, usually much higher than the first, before turning downward to a fairly low level; and for the remaining lessons, it lowers gradually. The typical experimental speed curve, with a somewhat atypical error curve, is illustrated in the three students' curves given in Figure 7. Here the order of the two highest error peaks is reversed, in this case the higher peak coming first.

The typical control group speed and accuracy curves are illustrated by the four students' curves given in Figure 8. Here the error curves should be noted

first, since the main emphasis was consistently on accuracy. The errors curve, in each case, is at a low level quite consistently; simultaneously, the speed

they will be able to force their speed to the 100-stroke level sooner than if they attend primarily to accuracy. They can do this in spite of a relatively high error rate.

b) Later on they will be able to use this technique to force their speed to the 150-stroke level.

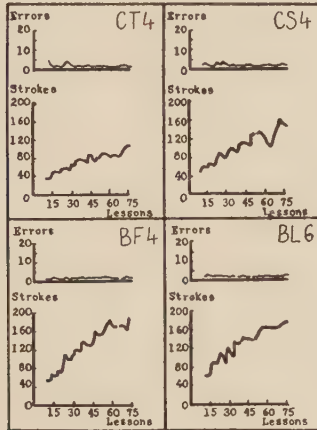


FIG. 8.—Speed and accuracy curves of four typical control students. Speed is in terms of strokes per minute, and accuracy is in errors per 100 strokes. Writing intervals are for ten minutes.

curve starts at a fairly low level and rises gradually throughout the whole series of lessons, the exact slopes of the curve varying with the individual.

In Figure 9 are illustrations of the typical experimental speed curve combined with the typical control accuracy curve. Three of these illustrations are from control students and one is from an experimental student.

INTERPRETATION

The results of this experiment will now be interpreted in terms of the three hypotheses stated previously.

The Experimental-BCD Group results confirm the first hypothesis concerning the practicability of having students aim for higher speed levels first, namely:

a) If elementary typewriting students attend to speed of continuous writing immediately after orientation, ignoring typescript errors,

This experimental group of 55 students, composed of three classes taught by three teachers, respectively, attending to speed of continuous writing immediately after orientation and ignoring typescript errors, writing mostly for ten-minute intervals, was able to force its speed to the 100-stroke level in only 19 lessons, or in half the 39 lessons required by the control group who attended primarily to accuracy. It was able to do this in spite of a relatively high error rate—7.9 errors per 100 strokes—which was three times larger than the rate of the control group. This experimental group was able later,

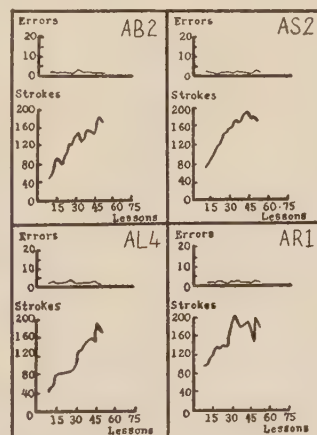


FIG. 9.—Speed and accuracy curves of four atypical students (AB₂, AS₂, and AL₄ are control students, and AR₁ is an experimental student). Speed is in terms of strokes per minute, and accuracy is in errors per 100 strokes. Writing intervals are for ten minutes.

after a series of lessons emphasizing accuracy and in a second speed drive, to use this technique for forcing speed to reach the 150-stroke level in a total of

only 33 lessons, in contrast to the control group, whose highest level in the semester of 73 lessons was only 141 strokes. Again it was able to do this in spite of an error rate even higher than that of the first speed drive—11.3 errors per 100 strokes—which was almost six times larger than the rate of the control group. These experimental group data are restated in Table 4.

The Experimental-A Class results confirm section (a) of the first hypothesis. This experimental class of 38 students reached 103 strokes at Lesson 21, com-

TABLE 4
EXPERIMENTAL GROUP DATA FOR LESSONS
19 AND 33

Lesson	Strokes Mean (in Strokes per Minute)	Equivalent Speed Reached by Control Group	Errors Mean (in Errors per 100 Strokes)	Percentage Higher than Control Group
19.....	102	In Lesson 39 (Not reached)*	7.9	316
33.....	151		11.3	565

* The highest is 141 in Lessons 71 and 73.

pared to 33 lessons required by the Control-A Class. In attaining this high speed level, the errors rate—4 errors per 100 strokes—was relatively large, being twice that of the control class.

Since there is no reason to believe that this class had less ability, its failure to reach the 150-stroke level in the second speed drive is probably to be explained by the fact that the experimental method, with an early emphasis on speed, had less appeal to this particular Experimental-A Class which elected the new course in personal-use typewriting and was told that the final speed requirement would not be as high as in the regular vocational course. The lack of motivation for speed seems to be shown as early as Lesson 9, when the speed of

55 strokes (S. D. 19) was significantly lower by 8 strokes than the 63-stroke level (S.D. 18) reached by the Experimental-BCD Group. The introduction of a grading scale in Lesson 8 appears to have brought a better speed response, since from Lessons 9 to 21, during the speed drive, the speed increase of this class, on the average, approximated that of the Experimental-BCD Group.

Yet the total effect on motivation of this absolute grading scale, which was too high for the class, is not entirely clear. (From one-half to three-fourths of the students in the class received "unsatisfactory" grades from Lessons 9 to 27.)¹⁷ Some students may have been positively motivated by these failing grades, and others, discouraged. Although some students fatalistically inscribed "E," the school failing mark, on their own test papers, yet on the whole it cannot be held that this grading scale affected the motivation in a negative manner, since this class averaged as much gain during these lessons as the experimental group.¹⁸ Students may not be impressed by an arbitrary rule which is obviously unreasonable. The type of exercise, writing continuously on new copy material for ten-minute intervals, may have carried its own motivation for speed, being even more potent than the directions or grading scale set up by the

¹⁷ The grading scale used by the students in marking their own papers, based upon pre-experimental studies, from Lessons 8 to 12 was: 60-69 strokes, "C"; 70-79 strokes, "B"; above 80 strokes, "A"; and below 60 strokes, "Unsatisfactory." This scale was raised in Lesson 13 and again in Lessons 15 and 17. For the subsequent experimental classes, a grading scale based on class-quartile results was used (see the lesson plans in the Appendix).

¹⁸ There is some evidence that the students in the two lower speed quartiles at Lesson 9 were less motivated for speed than those in the two upper quartiles, since the average lesson increment for the next ten lessons was lower for the former students.

teacher. At any rate, the failure of this class occurred in the first nine lessons; hence it seems most likely that the failure was more a result of the confused situation relative to the seriousness of the early speed emphasis. Although the arbitrary feature of the grading scale may have been too obvious to be fully impressive, the students were somewhat stabilized in trying for speed. Yet the gain was not sufficient to make up for the early loss. So many students failed to reach the 100-stroke speed in the first speed drive, it is not surprising that the second speed drive brought no better results. In fact, the results were not so good, the class attaining only 127 strokes, and not 150, at Lesson 37, at which time the emphasis was again shifted to accuracy. Simultaneously, the error rate was 5 errors per 100 strokes, somewhat more than three times larger than that of the control class.

The speed curves of individual experimental students reaffirm the first hypothesis. A number of students attained the 100-stroke goal and higher at Lesson 9 or soon thereafter (see Figs. 6 and 7). For example, take the cases of Student AM7 and Student CM5. AM7 had already reached the 100-stroke speed by Lesson 9 and went up to 137, 143, 152, and 188 at Lessons 11, 13, 15, and 19, respectively, with error rates around 5 errors per 100 strokes. CM5 had already reached the 123-stroke speed at Lesson 9 and went up to 131, 164, and 174 at Lessons 11, 13, and 17, with an error rate of about 5 errors per 100 strokes at Lesson 11 and thereafter decreasing. If the speed goal had been placed on an individual basis, instead of a class basis, these students, and others, might have been more potently challenged and have attained even higher scores.

It should be remembered at this point that the speed goal of 100 strokes per minute, or above, on new serial copy for the ten-minute writings was arbitrarily chosen on the basis of pre-experimental studies of student accomplishments. The words "or above" were added to the goal which originally was on "100 strokes" when it was realized that some students might reach the goal immediately and not be adequately challenged; the figures were not raised because it was felt that a higher goal might be discouraging to the slower students in the class. Probably the goal thus qualified is not as challenging to the faster writers as if it had been raised to 150 or even 200. What has been said of the speed goal of the first speed drive could likewise be said of the speed goal of the second speed drive. The speed goals as defined in figures were too low for many individual students, although better suited for the class as a whole. This first goal of 100 strokes appears to be a step in the direction of what Gilbreth was suggesting as the standard rate of the expert and may be accepting merely the implication that emphasizing speed before accuracy has a real value. The initial goal perhaps should be on an individual basis and should be higher for many students, if not all.

The total results of this experiment clearly support the first hypothesis, namely, the practicability of having students aim for higher speed levels first: with favorable factors of motivation, the experimental class may be expected to attain the 100-stroke and the 150-stroke levels, on the average, sooner than if it attended primarily to accuracy, and it may be expected to attain these speed levels in spite of relatively high error rates.

The Experimental-BCD Group re-

sults confirm the second hypothesis concerning the elimination of errors and retention of speed level, namely:

a) If students attend to speed first, ignoring errors, and later attend to accuracy, they will be able to reduce their high error rate within one semester to a level which approximates or equals that of students who gave primary attention to accuracy.

b) They will simultaneously be able to retain, with only a temporary drop, their high speed level while reducing their error rate.

At Lesson 63 the Experimental-BCD Group error rate of 2.0 (S. D. 1.6) approximated the 1.7 error level (S.D. 1.3) of the control group, the small dif-

ferences: (1) chance errors, which occurred only once out of many opportunities, disappeared when the student focused his attention and effort to accuracy, and (2) each repeated error, which recurred often before, when corrected reduced the error count by several points. The mean error and stroke rates for these lessons are repeated in Table 5.

During the fourteen lessons emphasizing accuracy in the second learning period, the sharp drop in the error rate—from 7.0 errors at Lesson 37, with a previous peak as high as 11.3 at Lesson 33, to 2.7 at Lesson 51—is also phenomenal (see Fig. 1). The speed curve dropped temporarily at Lessons 39 and 41 to levels approaching those significantly different from the 150-stroke level.¹⁹ The sharpness in drop during this accuracy drive also appeared to be the result of the elimination of the two types of errors mentioned before. The mean error and stroke rate for these lessons are shown in Table 6. After Lesson 51 the error rate gradually approximates 2.0 errors, where it tends to remain. Simultaneously, the speed rate is, with one exception, above 150 strokes. The mean error and stroke rates for these lessons are given in Table 7.

The Experimental-A Class data, covering 51 of the 73 lessons in the semester, did not yield conclusive evidence concerning section (b) of the second hypothesis. As far as they went, however, the data tended to confirm section (a) of this hypothesis. For example, during the eight lessons emphasizing accuracy in the first learning period, the high error rate of 5.0 errors per 100 strokes at Lesson 19 dropped phenomenally to 2.2 at Lesson 27. Simultaneously, the speed

¹⁹ The drop at Lesson 47 was likely due to the difficulty of the copy material, as noted previously (see n. 3 above).

TABLE 5
EXPERIMENTAL GROUP MEAN ERROR AND
STROKE RATES FOR LESSONS 19-27

Lesson	Errors	Strokes
19.....	7.9	102
21.....	6.6	106
23.....	4.6	100
25.....	3.8	115
27.....	2.8	103

ference of 0.3 error being insignificant, meeting only a .16 fiducial level, and maintained this same relationship thereafter at Lessons 67, 71, and 73. Simultaneously, this experimental group speed was at the 150-stroke level.

During the eight lessons emphasizing accuracy in the first learning period, the sharp drop in the error rate—from 7.9 errors per 100 strokes at Lesson 19 to 2.8 at Lesson 27—while the speed level was maintained at 100 strokes or above, is phenomenal (see Fig. 1). It will be recalled that Stuart expressed surprise at the sudden drop in error rate of her ten experimental students. A sampling of experimental students' papers indicated that this sharpness in drop was probably due to the elimination of two types of

level of 103 at Lesson 25 dropped to a level which may be considered significantly lower²⁰ and turned upward again in the next test. During the fourteen lessons emphasizing accuracy in the second learning period, the same pattern

TABLE 6

EXPERIMENTAL GROUP MEAN ERROR AND
STROKE RATES FOR LESSONS 33-51

Lesson	Errors	Strokes
33.....	11.3	151
35.....	8.1	143
37.....	7.0	150
39.....	4.7	141
41.....	4.3	142
43.....	3.7	151
45.....	3.9	146
47.....	3.5	141
49.....	2.9	151
51.....	2.7	153

in error change appeared. The high error rate of 5.1 errors at Lesson 37 also dropped phenomenally to 1.6 at Lesson 51. Simultaneously, the speed level of 127, which in this case did not approximate the goal of 150 strokes, dropped to a significantly lower level at Lesson 39.²¹ However, in this instance, the drop in speed can hardly be said to be only a temporary one, since the former high level was not recovered until Lesson 49. Although the error rate of this class dropped phenomenally, at no time during the fifty-one lessons did the error rate approximate or equal that of the Control-A Class. The Experimental-A Class data, then, confirmed the second hypothesis in so far as the high error rates reached during the speed drives dropped phenomenally during the accuracy drives and in that during the first accuracy drive the rate of speed dropped only temporarily.

The speed and accuracy curves of individual experimental students reaffirm

the second hypothesis. The error curves tended to be high during the first speed drive, going lower during the first accuracy drive; they tended to be higher during the second speed drive than during the first, dropping sharply during the second accuracy drive. During the accuracy drives, the speed level dropped only temporarily, if at all (see Fig. 6). The illustrations given in Figure 7 are similar, except the higher error peak appears during the first speed drive rather than during the second. These experimental students' curves may be contrasted with the typical control students' curves in Figure 8, which show error curves quite consistently at low levels as the speed curves rise more gradually. All these illustrations in Figures 6, 7, and 8 were chosen as cases which reaffirm the typical curves of the groups and not to illustrate the extreme cases. For example, in Figure 6, the error peaks may be higher or lower than the group average of 7.9 errors per 100 strokes at Lesson 19, but the extreme error rates were nearly 15.0. During the second speed drive, the error peaks shown in

TABLE 7

EXPERIMENTAL GROUP MEAN ERROR AND
STROKE RATES FOR LESSONS 52-73

Lesson	Errors	Strokes
55.....	2.1	152
59.....	2.2	160
63.....	2.0	146
67.....	2.0	159
71.....	2.1	161
73.....	2.0	164

Figure 6 may be higher or lower than the group average of 11.3 at Lesson 33, but the extreme error rates were nearly 37.0. In both Figures 6 and 7 the tendency of the experimental students' error curves to remain at a low level after Lesson 60,

²⁰ See n. 8 above.

²¹ See n. 14 above.

not dissimilar to the control students' error curves in Figure 8, indicates definitely that the early surplus of errors may be eliminated without a permanent drop in speed, if indeed any drop at all.

Of particular interest are the individual students' curves such as those given in Figure 9. They present instances of learning progress unexpected in terms of both the experimental and the control goals. In the case of the three control students—AB₂, AS₂, and AL₄—the error curves were held at consistently low levels, and yet the slants of the accompanying speed curves are much higher than might be expected. These students somehow got into the faster paces while the attention was directed to accuracy and while they held their errors to a minimum. On the other hand, in the case of one experimental student, AR₁, the speed curve was typically an experimental one, and yet the accompanying error curve remained at a relatively low level—much lower than might be expected. Analysis of such individual differences may prove, with further investigation, to be sources productive of other hypotheses concerning the teaching of speed and accuracy.

All in all, the accuracy results of both Experimental-BCD Group and Experimental-A Class present phenomenal drops in error rates; in a given number of lessons, for example, sixty-three lessons in the Experimental-BCD Group, the students had undergone two speed drives in which the error rates were unusually high, and yet later they eliminated enough of these errors to compare favorably with students who had stressed accuracy throughout. It is apparent that in the typewriting process, complex as it is, the initial error habits are not fixed as soon as has been implied by the traditional accuracy emphasis in teaching.

The occurrence of initial errors, many of which are simply chance errors, apparently has been taken too seriously. The possibility of directing the attention to speed separate from accuracy has also been largely overlooked. The relation between speed and accuracy will be discussed a little later. At the time that the error curves were dropping phenomenally during the first accuracy drive, the speed curve of the Experimental-BCD Group did not drop significantly, and that of the Experimental-A Class dropped significantly only temporarily. These results appear to be the opposite of the commonly accepted view that it is necessary to reduce the speed level in order to reduce the error rates, with a reduction of as much as 50 strokes suggested by some writers. The fact that this was not done in many individual cases is important; perhaps the fact that other students did let their speeds drop may be due partly to this erroneous common-sense opinion. The results of the second accuracy drive in the Experimental-BCD Group show only a temporary drop in speed, which again may not have been necessary. In the Experimental-A Class the speed curve drop at this time may be a result of a combination of causes, one of which was the class failure to attain the speed goal before the shift was made to accuracy. It is reasonable to suppose that the class morale by this time was not high in relation to class goals.

The accuracy results of the Experimental-BCD Group and the Experimental-A Class are also interesting in respect to their upper and lower limits. In the first speed drive, when the students were told to ignore errors, and hence their rates might have gone up as high as 100 errors per 100 strokes, why did the rates go up only to 7.9 and 5.0? And in the second speed drive, why were the

peak rates only 11.3 and 6.3, and the rates at the end of the drive only up to 7.0 and 5.1, respectively? (Of course, it should be remembered here that these group and class rates are averages. Some individual student rates in the first speed drive were as high as 15 and in the second speed drive were as high as 37.) It may be that the making of typescript errors up to a given number does not disturb the student when he is attending primarily to speed, but the making of errors beyond that number does disturb him sufficiently that he temporarily shifts his attention to accuracy. The lower limits of the error rates during the accuracy drives are of equal interest. As the Experimental-BCD Group error rate is dropping phenomenally and reaches a relatively low level at Lesson 63, approximately two errors per 100 strokes, why does it tend to remain there for the subsequent ten lessons? It is likely that the student becomes so accustomed to high error rates during the speed drives that the relatively low levels gained during accuracy drives appear very good in contrast, and he is not adequately motivated to exert the additional effort required for this high degree of accuracy.

The data of this study do not make very clear the relation between speed and accuracy. It has already been noted that, in a measure, speed is quite separate from accuracy, the student being able to attend primarily to one and then primarily to the other. The common-sense belief that a typist needs to go slowly in order to be accurate, and that if the typist makes many mistakes, he is typing too rapidly, has been condemned. In most of the group correlations of students' speed rates plotted against accompanying error rates, zero or near-zero coefficients were obtained, and generalizations from such results seem en-

tirely to overrule this common-sense belief in a close relationship between speed and accuracy. It would hardly be correct, however, to state that no relationship exists. In the Experimental-BCD Group, during Lessons 9-15 of the first speed drive, a coefficient of $+.26$ was found between students' strokes and absolute errors. On the other hand, in this same Experimental-BCD Group during the second speed drive, with strong pressure for speed a second time, Lessons 29-37, the coefficient was only $+.03$. During these two series of lessons, for the average of the group, the rise in speed rates is accompanied by a large increase in errors. But in individual cases of student results, sometimes a rise in speed is accompanied by a large increase in errors, sometimes by no increase in errors, and at times by an actual decrease in errors; and, when these results are combined in a group, they tend to offset one another. All in all, it might be said that the tendency in a speed drive is for some positive relationship to exist between speed and accuracy, and in an accuracy drive for some negative relationship to exist. It might be assumed that, while little relationship exists between speed and accuracy when the speed varies up and down between limited levels with the errors also remaining between limited levels, above or below these levels, either in speed or in accuracy, a closer relationship might be found. The awareness, on the part of both teachers and students, of the fact that this common-sense belief in a close relationship between speed and accuracy may be a fallacy should serve to give the student better control of the situation.

The Experimental-BCD Group results confirm the third hypothesis concerning terminal speed and accuracy, namely:

At the end of seventy-three lessons, students who attend to speed first, ignoring errors, and later attend to accuracy, repeating this cycle of speed and accuracy emphases, will have speed which is higher than that of students who attend primarily to accuracy, and they will have accuracy which is equal to that of the latter students.

As early as Lesson 63 the Experimental-BCD Group met these criteria. The speed level had consistently been higher than that of the Control-BCD Group, and at Lesson 63 the error rate dropped to a level which was not significantly different from that of the control group. These relationships continued through Lesson 73, when the experimental group speed was at approximately 160 strokes, about 25 strokes higher than the control group speed, and the experimental group error rate was at approximately 2.0 errors per 100 strokes, about 0.3 errors higher, but not significantly higher, than the control group error rate. In other words, the experimental group gained enough of a lead in stroke-speed during the speed drives to enable it to maintain a lead during the lessons required for reducing the error rate in comparison to the control group whose

error rate remained at about the one level and whose speed increased gradually.

Although the confirmation of this third hypothesis is of interest, this finding is considered of less importance for the typewriting learning process than the first and second hypotheses, since the purpose of this study is to investigate a particular phenomenon of learning, namely, the practicability of emphasizing speed before accuracy, and is not to promote and defend a teaching method *in toto*. It would be important to the theory of teaching elementary typewriting to find that the learning process could be carried out successfully by emphasizing speed before accuracy even if the terminal results of the experimental students merely equated those of the control students in both speed and accuracy. It would still be important if the terminal results showed the experimental students to have higher speed but a lower degree of accuracy. The practicability of emphasizing speed before accuracy would be shown in any of the three cases. In addition to the practicability, the results of this experiment tend to show that this procedure is also more efficient than emphasizing accuracy throughout.

CHAPTER IV

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

THE results of this experiment embody considerable evidence in favor of the following tentative conclusion: *Emphasizing speed before accuracy in elementary typewriting is practicable.* This means that, with reasonably equal motivation, students can force their speed to the 100-stroke level

in continuous writing sooner by attending primarily to speed rather than primarily to accuracy, even at the beginning of the learning process, and that they can attain this relatively high speed level in spite of a relatively high error rate despite the traditional assumption of slight hesitations associated with errors. This means that, with reasonably

equal motivation, students can reduce their high error rates phenomenally in a subsequent emphasis on accuracy. They can develop techniques whereby they can force their speed to the 150-stroke level in a second emphasis on speed and can reduce their high error rate in a second emphasis on accuracy. It means that they can gain a superior speed rate during the speed emphasis and maintain this superior speed rate while reducing the high error rate during the subsequent accuracy emphasis, compared to students who emphasize accuracy from the start and write with a low error rate and a gradually increasing speed.

This conclusion is of considerable import for methods of teaching elementary typewriting. Teachers can now adopt with confidence a method which places an initial emphasis on speed rather than accuracy, permitting the students to make large numbers of errors. They can free the students from the strait jacket which required high initial accuracy of typescript. The conclusion carries with it, however, the implication that the alternated emphasis on speed and accuracy shall be planned and controlled by the teacher, not unplanned and unlicensed. Further, it does not imply that all the truths regarding the teaching of speed first have been determined; much additional research still remains to be done.

RECOMMENDATIONS

The following recommendations for further investigation in teaching speed first in elementary typewriting grow out of this experiment:

1. The effectiveness of setting up speed and accuracy goals on an individual basis, rather than on a class basis, should be investigated. Individual differences are particularly impressive as one continues to analyze student scores.

It is entirely possible that speed and accuracy goals set on an individual basis might be much more effective in motivation, since at all times each student would be working toward his own challenging goal. The student who increases his speed rates easily or decreases his error rates quickly would not be tempted to compare himself with slower students and relax in his efforts. The student who progresses slowly would not be asked to shift his emphasis from speed to accuracy or from accuracy to speed prematurely because the class on the average had attained the speed goal or the accuracy goal. What growth in speed and accuracy would occur if students were more effectively motivated by individual goals? Such a setup would help to determine the length of the speed-accuracy cycle, i.e., in what lessons these emphases should occur.

Case studies should be made of individual students showing unusual records, such as those illustrated in Figure 9, starting as soon as the possibility of such attainment becomes apparent. If the classroom teacher could determine these cases early in the learning process, observe them at work, and gather objective data including motion picture recordings, it is possible that significant clues relative to surplus-tension relaxations and other, at present unknown, factors making for fast pace in writing while maintaining high accuracy would be found. Such in-the-process observations would seem to offer the most fruitful source for discovery of new and vital facts concerning the learning process.

2. The optimum speed-goal levels should be investigated. In this experiment the 100-stroke and 150-stroke goals were arbitrarily chosen after class results of beginning students had been studied. If the standard rate of the ex-

pert typist is considered to be 250 or more strokes, the 100-stroke goal is only a step in the direction of what Gilbreth suggested, accepting merely the implication that speed before accuracy has a real value. It may be that the 200- or 250-stroke goal from the start would be better. Blackstone has already suggested the 200-stroke rate for the small learning unit and the short writing interval. Ways and means of starting the student at the 200-stroke goal on continuous copy for ten-minute writings may be found, and they might show that this higher goal, even for continuous writings, would be better than the standards and procedures used in this experiment.

3. The optimum accuracy-goal levels should be investigated. In this experiment the accuracy goal was 1.0 error per minute or 1.0 error per 100 strokes in the first learning period accuracy drive. The accuracy drive terminated at the end of Lesson 27 even though the students had not met this goal, with the average error rate more nearly approximating 3.0 errors per 100 strokes. Should the accuracy drive have been continued until the accuracy goal was met, or was it better to shift the emphasis after a given number of lessons? Was the accuracy goal too high? and was the 3.0 error rate approximated a sufficiently high goal for the first learning period? It may be that the failure to attain the accuracy goal during the first learning period hindered attaining this same goal during the second learning period, causing the accuracy emphasis to be prolonged from Lessons 51 to 63. Is there an advantage in having experienced the high accuracy goal of only 1.0 error per 100 strokes which would transfer to the second accuracy drive? Or is the lower accuracy goal of 3.0 errors per 100 strokes adequate; and, if set at this point and

experienced by students, would the transfer to the second accuracy drive be just as beneficial as working a longer time to attain the higher goal?

4. Techniques for teaching the student how to accelerate his speed rate in continuous writing, in addition to those used in this experiment, should be investigated. These studies should include: (a) exact procedures for the student to follow and (b) ways of having the teacher convey instructions to the student. As to the first, further investigation should be made relative to the kind of precise movements required in the stroking process, the precise allocation of power in the finger muscles, and the determination of whether or not it is better to gain speed through shortening the interval between strokes or by accelerating the rate of individual strokes or both. In the present experiment only the standard typewriter was used; further investigation could show the utility of the electric typewriter in having the student experience the faster speed levels even though they returned to using the standard machine. In this experiment the ten-minute writing interval was adopted as standard for most of the practice. Further investigation should show whether or not longer intervals, for example, some twenty-minute writings, would be more effective. As to the second type of study, further investigation should be made relative to the use of motion pictures in conveying to the student the concept of good stroking movements in continuity writing. The electric pacer, calibrated for number of strokes per minute, might be found helpful to accustom the students to speed levels from 100 to 200 strokes, and for short periods of time, such as one or two minutes. In the present experiment the ways of conveying instructions were largely verbal, with

relatively little use of demonstration. Further investigations might deal with the choice of the teacher's words. It might be found that the teacher would be more effective if she talked less, with more carefully chosen words, and emphasized other devices.

5. The problem of the relationship between the varying size of component elements in the copy material and the speed and accuracy results should be investigated, using as a point of departure the data of this study. For example, the copy materials used in the different writings could be classified on the basis of statistical data describing the length of the words in terms of strokes or syllables, and then the speed

and accuracy results on the different kinds of copy materials could be compared. It might be found, contrary to present opinion, that difficulty of copy material is not closely related to length of word as measured either in strokes or in syllables. Hence the need for different criteria for composing copy material would be indicated.

6. The possibility of obtaining speed and accuracy data for continuous writing intervals during the earliest lessons should be investigated. In this experiment the first data for ten-minute writing intervals were obtained at Lesson 9. It might be feasible to do this at Lesson 5 and thus increase the knowledge concerning the early learning process.

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APPENDIXES

APPENDIXES

I. TEACHER'S LESSON PLANS FOR EXPERIMENTAL CLASSES

First Learning Period, Lessons 1 to 27

Aim of lessons 1-4.--To initiate students to touch type-writing, to some machine manipulations; to establish, in response to seeing the letters in the copy, the reactions in the correct fingers for each of the alphabetic keys. Starting in lesson 3, to imitate the fast typing of the teacher.

Lesson 1 Procedure: (Teacher's activities including the directions to the students)

1. Present the concept of touch typewriting. (time: 2 min.)

Since you need your eyes to follow the textbook copy, it is very essential that you typewrite without looking much at the keyboard. As you proceed, you will quickly catch on how to make the keyboard reaches without looking at the typewriter.

2. Have students do exercise for finding home keys. (time: 3 min.)

Place your hands at your sides. Raise hands to machine and with fingers feel the lower frame of machine. Feel the long space-bar. Run your fingers over lower row of keys, back and forth; depress the left shift key with left little finger and right shift key with right little finger.

Run your fingers over second row of keys. Let left little finger rest above the end key, the third finger above the next key, the second finger next, and the first finger next. This is home position for the left hand.

Let the right little finger rest above the next-to-end key on the right, the third finger over the next, the second finger next, and the first finger next. This is home position for the right hand.

Curve your fingers, the tip of each finger in the center of the key. Close your eyes and do this exercise several times. See how soon you can find the home position immediately, without these extra steps.

3. Teach the first unit in Exercise 1, "jerker." (time: 6 min.)

Insert the paper the best you can.

Find home keys without looking. Curve fingers, the tip of each finger in the center of each key.

Look at chart above "jerker." As I call the keys, you simply feel for the location. Do not stroke yet.

Feel the j--right hand, first finger.

e--left hand, second finger leaves home key and moves up for e. Now move finger back to its home key.
r--left hand, first finger leaves home key and moves up for r. Now move finger back to its home key.
k--right hand, second.
e--left hand, second, up, then back.
r--left, first, up, then back.
space-bar--side of right thumb.

Repeat all of this.

Write jerker as I call: j e r k e r space (three times).
Carriage to right. Write jerker by yourselves. (2 min.) Rest, close eyes. (1 min.)

4. Teach the next unit, "shirker."

Find home keys without looking.

Look at chart above "shirker." As I call, you feel.

Feel the s--left hand, third.

h--right hand, first, moves in for h, then back.
i--right hand, second, moves up for i, then back.
r--left, first, moves up, then back.
k--right, second.
e--left, second, up, then back.
r--left, first, up, then back.
space-bar--side of right thumb.

Repeat all of this.

Write shirker as I call: s h i r k e r space (three times).
Return the carriage to the right. Write shirker by yourself. (2 min.) Rest, close your eyes and relax. (1 min.)

5. Teach "worker."

Look at chart above "worker." As I call, you feel.

Feel the w--left, third finger moves up for w, then back.
o--right hand, third, up for o, then back.
r--left, first, up, back.
k--right hand, second.
e--left, second, up, back. Feel the r.

Write worker as I call: w o r k e r space (three times).
Carriage. Write worker by yourself. (2 min.) Rest, close eyes, relax. (1 min.)

6. Teach "form is good."

Feel the f--left, first; feel the o--right hand, third, up, back.
r--left, first, up, back.
m--right hand, first, down and outward. (look at it)
i--right hand, second, up for i, then back.
s--left hand, third. Feel the g--left, first, in, back.
d--left, second.

Write form is good as I call: f o r m i s g o o d space (twice).

7. Teach "persevere."

Feel the p--right hand, fourth, up, back. Keep other fingers close to home keys. Do this again.
e--left, second, up, back.
r--left, first, up, back.
s--left, third.

v--left, first, down.
Repeat all of this.

Write persevere as I call: p e r s e v e r e space (three times). Rest.

8. Have students write jerker, shirker, worker and form is good persevere by themselves. (time: 6 min.) During this time the teacher can check on the difficulties of individual students. Encourage the students; make the work seem easy.

Lesson 2 Procedure:

1. Review the concept of touch typewriting. Repeat exercise for finding home keys (see Lesson 1). Be certain the students understand the numbering for the fingers. Ask the students not to typewrite outside of class for the first ten lessons.

2. Teach "skill" in Exercise 1.

Insert the paper as best you can; find home position.
Look at chart above "skill." As I call, you feel.
Feel the s--left, third.

k--right hand, second.

i--right hand, second, up for i, back home.

l--right hand, third. Again feel l. Space-bar.

Write skill as I call: s k i l l space (three times).

3. Teach "salary."

Find home keys without looking. Look at chart above "salary." Feel.

Feel the s--left, third.

a--left, fourth.

l--right hand, third. Again the a.

r--left, first, up, back.

y--right hand, first, up and in, back. Space-bar.

Write salary as I call: s a l a r y space (three times).

Rest (1 min.)

4. Teach these machine manipulations: (time: 10 min.)

To put left paper-guide at zero; to insert paper by twirling knob (with paper-release tight); to set left marginal stop at 10 (right stop to far right); to set line-space lever at one; to return carriage and space a line by tossing carriage. For the latter, use the following exercise, teacher demonstrating:

Move carriage to left (teach location of releases). Toss carriage to right, spacing up a line. Repeat this.

First row of students, you toss carriage correctly. Ready,

toss. Second row, toss, etc. (Additional instruction given in later lessons.)

5. Teach "jerker" again.

Find home keys without looking. Curve your fingers, one finger to a key; keep fingers close to home keys. Look at chart and feel:

Feel the j--right hand, first.

e--left, second, up, back.

r--left, first, up, back.

k--right hand, second.

Write: j e r k e r space (three times).

6. Teach the concept of quick stroking. (time: 16 min.)

Quick stroking is not necessarily fast typing, e. g. if the intervals between strokings are relatively long, you have a slow rate of typing. Here you are teaching quick stroking, but not fast typing. The student may be put at ease by the concept of relaxing between the quick strokings.

To typewrite so that the printed letters will be clear, it is best to stroke each key with a very quick stroke. The tip of the finger reaches and gives the key an instantaneous push and instantly returns to home key. (demonstrate) (5 min.)

Write jerker as I call the keys. Be sure to stroke each key quickly and get back to home key quickly. j e r k e r space (three times). Write jerker by yourselves. (3 min.)

Write shirker: s h i r k e r space (three times). Do it alone. (4 min.)

Write worker: w o r k e r space (three times). Do it alone. (4 min.)

7. Have students write next page by themselves, writing each unit three times and repeating when finished. (time: 6 min.)

Lesson 3 Procedure:

1. Review the machine manipulations as in Lesson 2. (time: 5 min.)

2. Teach "experts, utilize, techniques." (time: 6 min.)

Feel the e--left, second, up, back quickly.

x--left, third, down, back quickly.

p--right hand, fourth, up, back quickly. Feel e again.

r--left, first; same finger over to t.

s--left, third; space-bar.

Write with quick stroking as I call; when I say "toss carriage," do so quickly and continue on the next line.

e x p e r t s space (four times) toss carriage, continue to write, e x p e r t s space (four times).

Feel the u--right hand, first, up, back quickly.

t--left, first, up and in, back quickly.

1--right hand, second, up, back quickly.
 1--right hand, third. Feel the i again.
 z--left, fourth, down, and back.
 e--left, second.

Write with quick stroking as I call: u t i l i z e space (four times), toss carriage, continue to write, u t i l i z e space (four times).

Feel the t--left, first, up and in, back quickly.

e--left, second, up, back quickly.

c--left, second, down.

h--right hand, first, in, back.

n--right hand, first, down.

i--right hand, second, up, back quickly.

q--left, fourth, up, back. Keep other fingers near the home keys.

u--right hand, first, up, back. Feel e and s.

Write with quick stroking as I call: t e c h n i q u e s space, etc.

3. Teach "personality" and "happiness." (time: 4 min.)

4. Teach 100-stroke timing, using "jerker." (time: 3½ min.)

Feel for keys as I call: i e r k e r space (four times).

Listen as I demonstrate. (At 200 strokes per minute; use electric pacer, if available, besides the teacher demonstration.) Now you try to imitate. Stroke quickly and make your keys sound like mine. Don't be concerned with errors; the aim here is to get your fingers working as fast as they can. (½ min.)

Listen again as I demonstrate. (At 100 strokes; after the faster rate, this will seem very slow.) Now you imitate this rate. I am sure that you can do this. (½ min.)

Write again, this time in your own way. (1 min.)

5. Teach "shirker" and "worker" as above. (time: 7 min.) If time remains, teach "form is good" (3½ min.), "persevere" (3½ min.) and "better" (3½ min.).

Make the work seem as easy as possible. Encourage the students to relax periodically. The beginner must be trained to have the utmost patience with himself in doing these new procedures.

Lesson 4 Procedure:

1. Review the machine manipulations. (time: 5 min.)

2. Teach first unit, Exercise 2. (time: 4 min.)

Look at chart above jiffy 1793. As I call, you feel.

Find the home keys without looking. Are you sure?

Feel the j i f f y space.

1--this number is the same as the letter "1."

7--right hand, first, up to top row, back. Repeat.

9--right hand, third, up to top row, back. Repeat.

Feel the 3--left, second, up to top row, back.
Listen as I demonstrate. (At 200 strokes per min. for $\frac{1}{2}$ min.)
Try to imitate me. Ignore mistakes. ($\frac{1}{2}$ min.)
Listen again as I demonstrate. (At 100 strokes per min.)
Try again to imitate me. (Students may omit writing figures, if desired.) This slower rate is very easy. ($\frac{1}{2}$ min.)
Write again, this time in your own way. (1 min.)

3. Teach other units in Exercise 2 in same way. (time: 20 min.)
4. Have students write experts utilize techniques. (time: 3 min.)
5. Have students write personality skill salary happiness. (time: 3 min.)

Aim of lessons 5-8.---To introduce serial writing without charts; to continue the speed emphasis for intervals gradually increasing from one-half to ten minutes.

Lesson 5 Procedure:

1. Review finding home keys. This is important because confidence will lessen the desire to look at keyboard. Remind students that it is better for them not to typewrite outside of class.
2. Review units in Exercise 2 as in Lesson 4, demonstrating as is necessary. (time: 20 min.)
3. Teach Exercise 4. (time: 11 min.) Read introductory statement giving setting for poem. (1 min.) Hereafter bring out the thought content of all exercises. Do it quickly in some novel manner.

Feel the keys as I read the words: he says he was once (repeat, assisting any student who cannot find a key by reviewing that location for the entire class). (1 min.)
Write this line by yourselves. (1 min.)

Teach the next four lines in the same manner. (8 min.)

4. Review last part of Exercise 1. (time: 4 min.)

Lesson 6 Procedure:

1. Review inserting paper; check on student's position. (5 min.)
2. Teach last four units, Exercise 3 as in 2, Lesson 4. (16 min.)
3. Teach Exercise 4b and c as in 3, Lesson 5. (5 min.)
4. Exercise 4, last six lines. Have students write by themselves.

Teacher uses this time to check students individually on fingering, manipulations, and positions. (8 min.)

5. Student's choice of Exercises 1-4 for review. (7 min.)

Lesson 7 Procedure:

1. Test students on alphabetic key reaches. Have students write alphabet in longhand on a blank sheet. As students look at this sheet, dictate the alphabet in 26 seconds. Repeat this twice. (By this time, the student should know at least twenty, if not all, of the twenty-six key locations. The discovery that he knows these will give him confidence. (time: 7 min.)

Which, if any, letters did you miss? Mark your paper. Select a unit containing the troublesome key and practice several times. (2 min.)

2. Have students diagnose their own timing. (time: 6 min.)

Write Exercise 4 at your best timing, disregarding errors. (1 min.) Record your total strokes. Counting 100 strokes as A, 85-99, B, 70-84, C, 60-69, D, grade your own paper. Repeat this. (1 min.)

Write Exercise 5 at your best timing. (2 min.) Find your average and grade. Write the last two lines only, putting on shift lock. If you finish, always repeat what you are writing. (2 min.) Average and grade.

3. Exercise 6. (time: 11 min.)

Feel for keys as I dictate these words. (1 min.)

Write this at your best timing, as rapidly as you can--disregarding any and all errors. (1 min.) (Do same for next three verses.) (6 min.) Select the best of your one-minute writings and grade your paper. (1 min.)

Write this poem about the fire-fly rapidly. (2 min.) Grade. (1 min.)

4. Have students practice to improve timing. (time: 21 min.)

Turn to any exercise we have written and write your very fastest. (5 min.)

I will time you to show you how you are improving. (1 min.) Grade (1 min.) (Repeat this procedure on two other selections. 14 min.)

Lesson 8 Procedure:

1. Teach the apostrophe, capital, colon, semi-colon, comma, period, and dash, using Exercise 7a. (time: 5 min.)

Practice ($\frac{1}{2}$ min. each): DON'T THIS: The It
The potato's vinegar's head; cellar, dead.
--The vinegar's

Write Exercise 7a twice or more in the next 5 min. Force your speed. (5 min.) Repeat 7a, doing better. (5 min.) Indicate your better copy by crossing out with pencil your poorer one.

2. Teach the colon and exclamation, using 7b. (time: 13 min.)

Practice ($\frac{1}{2}$ min. each): Tommy: Mother, please
Mother: Why, Tommy, What an idea! Imagine
the monkeys Aunt Roxana is here!

Write 7b twice in the next 5 min. (5 min.) Did you succeed? Try again. (5 min.)

3. Teach the parenthesis, using Exercise 8c. (time: 9 min.)

Write: Loving Ma (Queen Victoria) (3 min.)

Write 8c twice or more in the next 5 min. (5 min.) Grade. (1 min.)

Collect Exercise 7a, grade, and enter on a class chart. For a grading scale to fit the class, arrange the scores in sequence and grade the highest quartile, A, the second, B, the third, C, and the fourth, D. Use this same scale for the next three lessons. Keep raising it in future lessons enough to challenge the students but not too much to discourage them. When starting any timed period, it is well to give two signals such as "ready, begin" or "ready, start." At the end of the period, a definite "STOP" is called. The additional "Take out your papers" will be an effective check on those students who may hesitate to stop.

Aim of lessons 9-15.--To continue the speed emphasis on ten-minute writings.

Lesson 9 Procedure:

1. Teach the question mark, using Exercise 8d. (2 min.)
2. Review colon, comma, period, parentheses, using 8c. (4 min.)
3. Have students write 8d rapidly. (5 min.)
4. Have students write Exercise 7 rapidly. (9 min.) Grade. (2 min.)
5. Introduce the ten-minute test, using Exercise 9.

At the top of a new sheet, write your name carefully. If

you do not succeed in writing it accurately the first time, space down and try again. (Hereafter always insist on accurate names at top of sheets.)

Try to write Exercise 9 once or more in the next ten minutes. Make approximate reaches and do not worry about any errors. The aim is to push your rate to 100 strokes per minute. (10 min.) Grade. (3 min.)

6. Introduce the three-minute Blackstone "C" test. Permit the student to try to accomplish in the shorter period what he failed to do in the ten-minute period. Collect Exercise 9, grade again and enter on class chart and return papers and make individual comments.

Lesson 10 Procedure:

1. Exercise 10. (10 min.)
2. Exercise 7c. (10 min.)
3. Exercise 8a and b. (2 min.) Exercise 8e. (2 min.)
4. Exercise 7. (10 min.) Have students grade. (2 min.)
Collect 8a, 8b, and 8e, and grade for chart. Notice spacing.

Lesson 11 Procedure:

1. Exercise 8. (Always introduce exercise by mentioning something concerning its content. Be concise.) (10 min.)
2. Exercise 9. (10 min.) Grade the better of 8 and 9. (3-5 min.)
3. Exercise 11. (10 min.) Grade. (3-5 min.)
4. Blackstone "D" test. (3 min.)
Collect Exercise 11 for chart.

Lesson 12 Procedure:

1. Teach the quotation marks, using Exercise 12b. (time: 11 min.)
Write: The Arab says, "A fine morning to you!" (2 min.)
The Turk says, "God grant you his blessings!" (2 min.)
The Persian greets you with "May your shadows never grow less!"
(3 min.)
Write 12b twice or more in the next four minutes. (4 min.)
2. Review the question mark, using 12c. (time: 10 min.)
Practice: How do you sweat? (2 min.) How can you? (2 min.)
(Continue with other sentences or phrases.)
3. Exercise 11. (10 min.) Grade. (2 min.) Write 11d. (2 min.)

Collect Exercise 11 for casual inspection. If a student fails to make a C-grade, encourage him to come to you for extra help.

Lesson 13 Procedure:

1. Exercise 7. (10 min.) Grade. (2 min.)
2. Exercise 8. (10 min.) Grade. (3-5 min.)
3. Exercise 13. (10 min.) Grade. (3-5 min.)
4. Blackstone "E" test. (3 min.)

Collect Exercise 13 for chart. Revise the grading scale.

Lesson 14 Procedure:

1. Teach special keys, using Exercise 14. (time: 24 min.)

Feel first for keys and then practice: check for \$11.42
(1 min.) policy #6789 Z (1 min.) July 30, (1 min.)
August 14, (1 min.) 15 days. (1 min.)

Write 14a twice or more in the next six minutes. (6 min.)

Feel first for keys and then practice: August 16, (1 min.)
#3141 for \$4.58, (1 min.) on June 7. (1 min.)
Account #2, (1 min.) on June 9. (1 min.)

Write 14b twice or more in next 8 min. (8 min.)

2. Exercise 9. (10 min.) Grade. (2 min.)

Collect Exercise 9 for casual inspection. Take drastic action against the habit of striking-over. Do individual exhorting.

Lesson 15 Procedure:

1. Practice figure phrases in Exercise 14c. (3 min.) Have students write for five minutes on 14c. (5 min.) Practice figure phrases in 14a. (3 min.) Write 14a. (9 min.) Grade. (3-5 min.)
2. Exercise 15. (10 min.) Grade. (3-5 min.)
3. Blackstone "A" test. (3 min.)

Collect Exercise 15 for chart.

Aim of Lessons 16-21.--To push students definitely to the 100-stroke speed or above on ten-minute writings; beginning in lesson 18, to encourage students having this 100-stroke speed to retain their top speed and reduce errors gradually.

Lesson 16 Procedure:

1. Exercise 16. (10 min.) Grade. (1 min.)

2. Exercise 12. (10 min.) Grade, teacher putting best scores on the board. (2 min.)
3. Exercise 13. (10 min.) Grade, as above. (2 min.)
4. Exercise 14. (10 min.)

Collect the best ten-minute writing and grade for chart.

Lesson 17 Procedure:

1. Exercise 12. (10 min.) Grade. (2 min.)
2. Exercise 13. (10 min.) Grade. (3-5 min.)
3. Exercise 17. (10 min.) Grade on strokes as before; also have students mark each error--encircle neatly with pencil. (3-5 min.)
4. Blackstone "B" test. (3 min.)

Collect Exercise 17 and grade for chart.

Lesson 18 Procedure:

1. Use favorite poem, Exercise 18a, as a means of forcing faster stroking. Read in unison this poem; bring out the music and read it with enjoyment. (1 min.) Review the exclamation point, apostrophe, and hyphen. (4 min.) Have students write quickly. (5 min.)
2. Exercise 14. (time: 11 min.)

If you do not yet write at 100 strokes, keep pushing up your rate, regardless of the errors you make. If you can do this, begin now to decrease the number of errors. Do this gradually; keep your same speed; you do not need to slow down in order to be accurate. (10 min.)

Mark your total strokes. Did you keep up your best speed? We will not count the errors until the next time. (1 min.)

3. Exercise 15. (time: 12 min.)

Do this better than you did Exercise 14. (10 min.)

Mark your total strokes. How many more or less than 1000? (2 min.)

4. Choice of Exercise 12 to 15. Treat as in 3. (time: 12 min.)

Collect the best ten-minute writing for chart. Be business-like in the collection of copies. Insist that student's name be carefully written. Permit no erasures nor strike-overs in

the name. Individual correction is more effective than class announcements.

Lesson 19 Procedure:

1. Exercise 18b. Treat as in 1, Lesson 18. (10 min.)
2. Exercise 15. (10 min.) Grade. (3-5 min.)
3. Exercise 19. (10 min.) Grade. (3-5 min.)
4. Blackstone "C" test. (3 min.)

Collect Exercise 19 for chart. Make new grading scale, if desired. Also collect three-minute test.

Lesson 20 Procedure:

1. Exercise 20a. Treat as in 1, Lesson 18. Choose some teaching point to emphasize (carriage throw or indenting.) (10 min.)
2. Exercise 14. (10 min.) Try to have students enjoy typing.
3. Exercise 15. (10 min.) Make the writing seem easy.
4. Exercise 16. (10 min.) Compliment students wherever possible.

Collect the best of Exercises 14-16 for chart.

Lesson 21 Procedure:

1. Exercise 20b. Treat as in 1, Lesson 20. (10 min.)
2. Exercise 18. (10 min.) Grade. (3-5 min.)
3. Exercise 21. (10 min.) Grade. (3-5 min.)
4. Blackstone "D" test. (3 min.)

Collect Exercise 21 and 3-minute test for chart.

Aim of Lessons 22-27.--To encourage all students to retain top speed and reduce errors gradually.

Lesson 22 Procedure:

1. Exercise 22. (10 min.) Have students encircle errors carefully. (5 min.)
2. Exercise 21. (10 min.) Have students keep this exercise, make a list of the errors, and return at next lesson.
3. Exercise 23. (15 min.) Have students write each part three

times, count errors and divide by 3, and enter averages.

Lesson 23 Procedure:

1. Exercise 23. Have students write each part twice and find the average error-rate. (10 min.)
2. Exercise 24. (10 min.) Grade. (3-5 min.)
3. Exercise 25. (10 min.) Grade. (3-5 min.)
4. Blackstone "E" test. (3 min.)

Collect Exercise 25 and three-minute test for chart. Besides grading on strokes, set up an error scale (on quartile basis) and grade on accuracy separately.

Lesson 24 Procedure:

1. Exercise 26. Have students write groups of words, such as "iron sinks," and write five times correctly. Write on board: "When finished, make a perfect copy of 26a. Then make three perfect copies of 26b and 26c." (time: 15 min.)
2. Exercise 25. (10 min.)
3. Exercise 28. (time: 15 min.)

Fold your $8\frac{1}{2} \times 11$ paper into $8\frac{1}{2} \times 5\frac{1}{2}$ size. Write two copies of 28a on a half sheet. Place your writing neatly on page. Guess at distances and check later. (8 min.) Do the same for 28b and 28c. (7 min.)

Collect perfect copies of 26a-c for chart. Have students keep Exercises 25 and 28, make a list of the difficult words and return papers at next lesson.

Lesson 25 Procedure:

1. Have students practice on their lists of hard words, either writing them ten times correctly or incorrectly (Dunlap theory). (5 min.)
2. Exercise 19a and b. (5 min.) Grade. (3-5 min.)
3. Exercise 22. (10 min.) Grade. (3-5 min.) Emphasize even margins and neatness.
4. Exercise 29. (10 min.) Grade. (3-5 min.) (marking errors too)

5. Repeat Exercise 29 for five minutes. (5 min.)

Collect Exercise 29 and grade on strokes and accuracy for chart.

Lesson 26 Procedure:

1. Exercises 23 and 24. (time: 20 min.)

Make two copies of 23a on a half-sheet. Place your work to look well. Do not make false starts; write at least five lines on each sheet. Continue until you have a perfect copy. (Use both sides of paper) With a pencil, cross out the work in which there are errors; hand in all sheets used.

Do the same for 23b-d; also for 24a-e.

2. Exercises 25 and 26. Same as above. (time: 20 min.)

Collect all work for casual inspection.

Lesson 27 Procedure:

1. Exercise 30. Same as 1, Lesson 26. (time: 20 min.) Grade.

(3-5 min.)

2. Exercise 31. (10 min.) Grade. (3-5 min.)

3. Exercise 30, in three- or five-minute tests as time permits.

Collect Exercise 31 and grade for chart.

II. TEACHER'S LESSON PLANS FOR CONTROL CLASSES
(IN PART ONLY)

First Learning Period, Lessons 1 to 27

Aim of lessons 1-4.---Same as for experimental classes, except starting in lesson 3, the emphasis is not on fast typing but on accurate key reaches only as fast as the student can type accurately.

Lessons 1 and 2 Procedures: Same as for experimental classes.

Lesson 3 Procedure:

1. Review the machine manipulations as in lesson 2. (time: 5 min.)
2. Teach "experts, utilize, techniques." (time: 6 min.)

Feel the e--left, second, up, back quickly.
x--left, third, down, back quickly.
p--right hand, fourth, up, back quickly. Feel e again.
r--left, first; same finger over to t.
s--left, third; space-bar.

Write with quick stroking as I call; when I say "toss carriage," do so quickly and continue on the next line. Plan your reaches, stroke quickly and then rest. e x p e r t s space (four times) toss carriage, continue to write, e x p e r t s space (four times).

Feel the u--right hand, first, up, back quickly.
t--left, first, up and in, back quickly.
i--right hand, third. Feel the i again.
z--left, fourth, down, and back. Feel the e with the left second.

Plan your reaches, stroke quickly as I call: u t i l i z e space (four times) toss carriage, continue to write, u t i l i z e space (four times).

Feel the t--left, first, up and in, back quickly.
e--left, second, up, back quickly.
c--left, second, down.
h--right hand, first, in, back.
n--right hand, first, down.
i--right hand, second, up, back quickly.
q--left, fourth, up, back. Keep the other fingers near home.
u--right hand, first, up, back. Feel e and s.

Plan your reaches, stroke quickly and rest: t e c h n i q u e s space (four times) toss carriage, continue to write, t e c h n i q u e s space, etc.

3. Teach "personality" and "happiness." (time: 4 min.)
4. Teach quick stroking at a slow rate of typing, using "jerker." (time: 3½ min.)

Feel for keys as I call: j e r k e r space (four times).

Listen as I demonstrate (at 50 to 75 strokes per minute for ½ min.; also use the electric pacer, if available, besides teacher demonstration.) Now you try to imitate. Stroke quickly and then relax; plan the next reach, stroke it quickly, and then relax again, etc. (½ min.)

Listen again as I demonstrate (at same speed). Now you try again to imitate. I am certain that you can do it.

Plan your reach, stroke quickly, and then relax. (½ min.)

Write again, this time in your own best way. (1 min.)

5. Teach "shirker" and "worker" as above. (time: 7 min.)

If time remains, teach "form is good" ($3\frac{1}{2}$ min.), "persevere" ($3\frac{1}{2}$ min.), and "better" ($3\frac{1}{2}$ min.).

Make the work seem as easy as possible. Encourage the students to relax periodically. The beginner must be trained to have the utmost patience with himself in doing these new procedures.

Lesson 4 Procedure:

1. Review the machine manipulations. (time: 5 min.)

2. Teach the first unit, Exercise 2. (time: 4 min.)

Look at chart above jiffy 1793. As I call, you feel.

Find the home keys without looking. Are you sure?

Feel the 1 1 f f y space.

1--this is the key for the letter "l".

7--right hand, first, up to top row, back. Repeat.

9--right hand, third, up to top row, back. Repeat.

3--left, second, up to top row, back.

Listen as I demonstrate (at 50 to 75 strokes per minute for $\frac{1}{2}$ min.) Try to imitate me. (Students may omit writing figures, if desired.) I think you can do this; it is really very easy. ($\frac{1}{2}$ min.)

Write again, this time in your own best way. (1 min.)

3. Teach other units in Exercise 2 in same way. (time: 20 min.)

4. Have students write experts utilize techniques. (time: 3 min.)

5. Have students write personality skill salary happiness.

(3 min.)

Aim of lessons 5-8.--To introduce serial writing without charts; to continue to teach accuracy in key reaches by having the students make "grading" copies.

Lesson 5 Procedure:

1. Review finding home keys. This is important because confidence will lessen the desire to look at keyboard. Remind students not to type outside of class. (time: 2 min.)

2. Review units in Exercise 2 as in lesson 4, demonstrating as is necessary. (time: 20 min.)

3. Teach Exercise 4. (time: 11 min.) Read introductory statement giving setting for poem. (1 min.) Hereafter bring out thought

content of all exercises. Do it quickly in some novel manner.

Feel the keys as I read the words: he says he was once (repeat, assisting any student who cannot find a key by reviewing that location for the entire class.) (1 min.)

Write this line by yourselves. (1 min.)

Teach the next four lines in same manner. (8 min.)

4. Review the last part of Exercise 1. (4 min.)

Lesson 6 Procedure:

1. Review inserting paper; check on student's position. (5 min.)
2. Teach last four units, Exercise 3 as in 2, lesson 4. (time: 16 min.)
3. Teach Exercise 4b and c as in 3, lesson 5. (5 min.)
4. Teach Exercise 4, last six lines. Have students write by themselves. Teacher uses this time to check students individually on fingering, manipulations, and positions. (time: 8 min.)
5. Student's choice of Exercises 1-4 for review. (7 min.)

Lesson 7 Procedure:

1. Test students on alphabetic key reaches. Have students write alphabet in longhand on a blank sheet. As students look at this sheet, dictate the alphabet in 26 seconds. Repeat this twice. (By this time, the student should know at least twenty, if not all, of the 26 key locations. The discovery that he knows these will give him confidence. (time: 7 min.)

Which, if any, letters did you miss? Mark your paper. Select a unit containing the trouble-some key and practice several times. (2 min.)

2. Have students diagnose their own writing. (time: 6 min.)

Write Exercise 4 in your most perfect manner. (1 min.) Mark your errors, if any; counting no errors as A, 1 error, B, 2 or 3 errors, C, and 4 errors, D, grade your own paper. Repeat this. (1 min.)

Write Exercise 5 at your best accuracy. (2 min.) Mark your errors and grade. Write the last two lines only, putting on shift lock. If you finish, always repeat what you are writing. (2 min.) Grade.

3. Exercise 6. (time: 11 min.)

Feel for keys as I dictate these words. Be careful.
(1 min.)

Write this in your most perfect manner. Go only as fast as you can keep control. (1 min.) (Do the same for the next three verses. 6 min.)

Select the best of your one-minute writings and grade.
(1 min.)

Write this poem about the fire-fly very carefully. (2 min.) Grade. (1 min.)

4. Have students practice to improve timing. (time: 21 min.)

Turn to any exercise we have written and write carefully.
(5 min.)

I will time you to show you how you are improving. (1 min.) Grade. (1 min.) (Repeat this procedure on two other selections. 14 min.)

Lesson 8 Procedure:

1. Teach the apostrophe, capital, colon, semi-colon, comma, period, and dash, using Exercise 7a. (time: 5 min.)

Practice ($\frac{1}{2}$ min. each): DON'T THIS: The It
The potato's vinegar's head; cellar, dead.
--The vinegar's

Write Exercise 7a, making a grading copy. When you succeed, do 7c. (10 min.) Indicate plainly your grading copy by placing the grade in the right margin. Cross out the poorer ones.

2. Teach the colon and exclamation, using 7b. (time: 13 min.)

Practice ($\frac{1}{2}$ min. each): Tommy: Mother, please
Mother: Why, Tommy, What an idea! Imagine the monkeys
Aunt Roxana is here!

Make a grading copy of 7b. When you succeed, do 7c. (10 min)

3. Teach the parenthesis, using Exercise 8c. (time: 9 min.)

Write: Loving Ma (Queen Victoria) (3 min.)

Write 8c, making a good copy. When you succeed, do 8a and b. (6 min.)

Collect Exercise 7a only, grade, and enter on a class chart.

It is optional whether the C or D grades are used. The grading scale should be high enough to challenge the students but not too high to discourage them.

When starting any timed period, it is well to give two signals such as "ready, begin" or "ready, start." At the end of the

period, a definite "STOP" is called. The additional "Take out your papers" will be an effective check on those students who may hesitate to stop.

Aim of lessons 9-15.--To continue the accuracy emphasis in grading copies.

Lesson 9 Procedure:

1. Teach the question mark, using Exercise 8d. (2 min.)
2. Review colon, commas, period, parentheses, using 8c. (4 min.)
3. Have students write Exercise 8d carefully. (5 min.)
4. Have students write Exercise 7c for a grading copy; then ua and 7b. (time: 11 min.)
5. Introduce the ten-minute test, using Exercise 9.

At the top of a new sheet, write your name carefully. If you do not succeed in writing it accurately the first time, space down and try again. (Hereafter always insist on accurate names at top of sheets.)

Try to write Exercise 9 very accurately. The grading scale for ten minutes is: 0, 1, or 2 errors, A; 3-5 errors, B; 6-8 errors, C. The aim here is to keep your error rate very low. (10 min.) Grade. (3 min.)

6. Introduce the three-minute Blackstone "C" test. Permit the student to try to accomplish in the shorter period what he failed to do in the ten-minute period. (3 min.)
Collect Exercise 9 and three-minute test, grade again and enter on class chart; return papers and make individual comments.

Lesson 10 Procedure:

1. Exercise 10 for grading copies. (10 min.)
2. Exercise 7c. Have students write each erroneous word five times correctly and repeat 7c. (8 min.)
3. Exercise 8a and b and e. (4 min.)
4. Exercise 7. (12 min.)

Collect 8a, 8b, and 8e and grade for chart. Notice spacing.

Lesson 11 Procedure:

1. Exercise 8. (Always introduce exercise by mentioning something concerning its content. Be concise.) (10 min.)
2. Exercise 9. (10 min.) Make a list of erroneous words. (4 min.)
3. Exercise 11. Encourage accurate writing for ten minutes. (10 min.) Grade. (3-5 min.)
4. Blackstone "D" test. (3 min.)
Collect the Exercise 11 for chart.

Lesson 12 Procedure:

1. Teach the quotation marks, using Exercise 12b. (time: 11 min.)
Write: The Arab says, "A fine morning to you!" (2 min.)
The Turk says, "God grant you his blessings!" (2 min.)
the Persian greets you with "May your shadows never grow less!" (3 min.)
Write 12b carefully. (4 min.)
2. Review the question mark, using 12c. (time: 10 min.)
Practice: How do you sweat? (2 min.) How can you? (2 min.) (etc.)

3. Exercise 11 for grading copies. (time: 14 min.)
Collect any grading copies. If a student fails to hand in a satisfactory number of copies, encourage him to come to you for extra help.

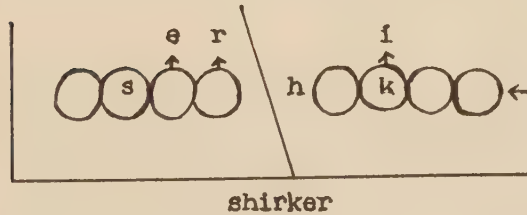
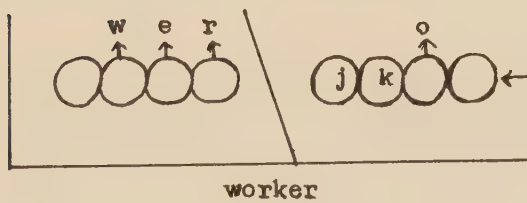
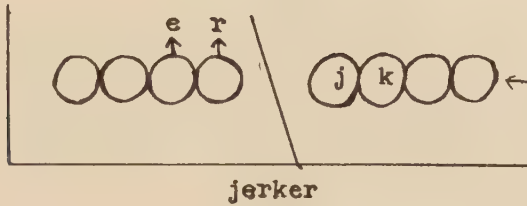
Lesson 13 Procedure:

1. Exercise 7 for grading copies. (12 min.)
2. Exercise 8 for grading copies. (11 min.)
3. Exercise 13 for ten minutes of writing. (10 min.) Grade. (3-5 min.)
4. Blackstone "E" test. (3 min.)
Collect Exercise 13 for chart and any grading copies. The grading scale for three-minute tests is: 0 errors, A; 1 error, B; 2 errors, C.

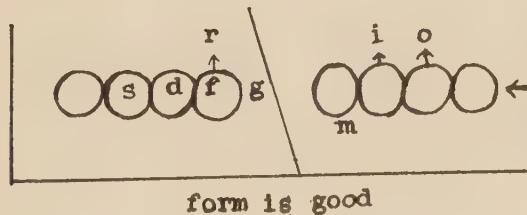
III. STUDENT'S TEXT

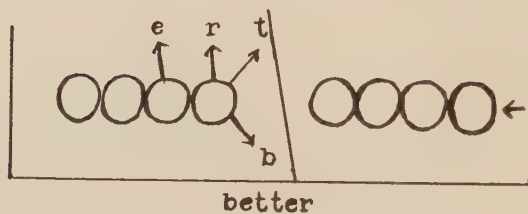
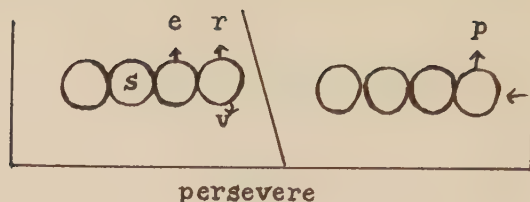
Exercise 1

Which are you most of the time, a shirker, jerker, or worker?

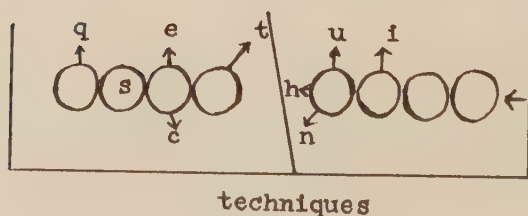
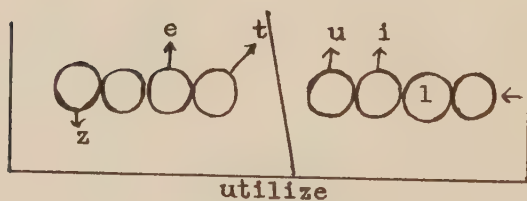
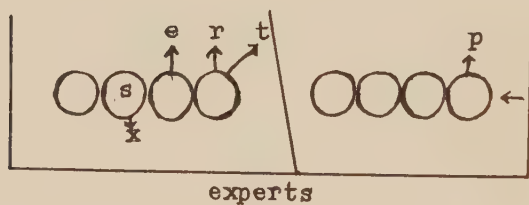


Sometimes you overhear skilled persons making these comments to beginners:

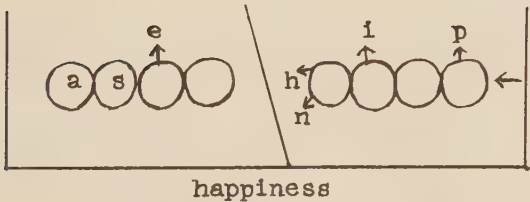
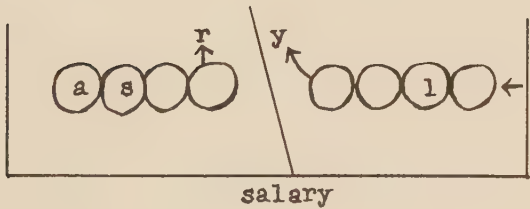
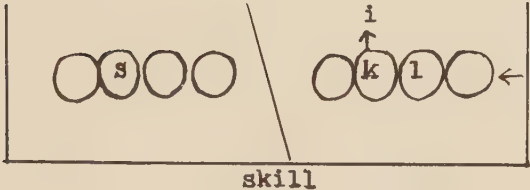
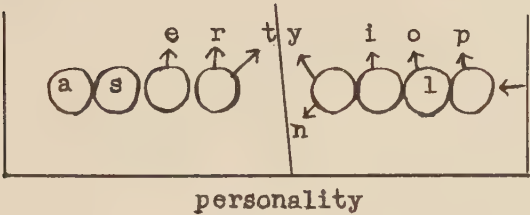




Are you an expert in any of the outdoor sports?



Here is a drama in four words:



IV. MATERIALS FOR TEN-MINUTE TESTS AND SCHEDULE
FOR SCORING TESTS

Ten-Minute Tests

Lesson 27 Exercise 31

Lesson 51 Exercise 55

Lesson 73 Exercises 62 and 69

Schedule for Scoring Tests

Exercise 31

PRECEDENTS IN LETTER WRITING. 31

Did you ever think about our fashions in writing letters? For example, take the older type of business letter. "My dear sir: Your valued and esteemed communication of yesterday is before me. I would be greatly pleased to see you at my office at any time suiting your convenience. Yours very truly." In the name of common sense why should one man call the other fellow "My dear sir," when neither "my" nor "dear" expressed his feelings? Why did he praise the communication he has received and why did he go out of his way to tell the writer that he was his and very truly? It is a fashion.

A letter written a century ago from the quill of somebody who wore a wig and silk trousers, and ordering a pair of boots begins with "The right worthy and honorable Master Smith," and closes by telling him that the writer was his "most humble and obedient servant," when honestly he was anything but that. Even if a man invited another to participate in a duel the following morning at sunrise, his letter closed with the same "Your most humble and obedient servant."

Excellent business men, capable of being entrusted with big affairs, are not brave enough to break with custom. Writing a letter to Miss Jones, they begin by telling her that she is a dear and end by remarking that they are hers, when as a matter of fact they never saw Miss Jones nor ever expect to do so. Fashion dictates today in letters.

Exercise 55

The occupationally intelligent worker knows	45
the value of time. He knows which hours belong to	97
him and which to his employer. He conscientiously	149
tries to be "on time" for his work, and to put	198
aside all personal matters during working hours.	247
What the employer dislikes is "loafing" or	300
"dawdling over work." This means taking more	348
time for a task than is needed. The employee	395
should work hard when he works and then relax at	444
the proper intervals.	466
An occupationally intelligent worker must be	514
alert in catching errors. These mistakes may be	564
those made by his superiors or co-workers. They	614
may creep into pieces of work which come to his	662
desk,--work for which he becomes responsible. It	713
is not uncommon for one little mistake to cost	760
the employer a large sum; on the other hand, one	809
little mistake detected may save the firm the	855
equivalent of the employee's salary.	893
The worker who is occupationally intelligent	941
is observing. As he goes along, he picks up in-	991
formation, which will increase his efficiency. He	1043
does this, not in a snoop or gossip manner, but	1093
knowing that he should have certain information	1141
about the business.	1161
Most employers are willing to teach the	1204
worker certain requirements of his job, but cer-	1253
tainly they should not have to take the time for	1300
those things which should be noted by keen observa-	1350
tion.	
In these days much is expected of the office	1401
worker. He must have a general business back-	1449
ground plus good common sense, energy, and ambi-	1494
tion.	1500

Exercise 62

PAPER MONEY.

	13
Paper money is used because it has several	59
important advantages. It is more convenient to	108
handle, carry, and store the metal coins. It	156
costs less than metal money, and it saves the	202
loss that would result from the wear of coins. .	249
There are two kinds of paper money: represen-	296
tative money and credit money.	325
Representative money are warehouse receipts,	373
certifying that a certain amount of standard gold	423
or silver money is being held by the government	471
and will be given to the holders of these certif-	521
icates whenever they ask for it.	554
Credit money consists of the promissory notes	603
of the government or of a national bank. Credit	653
money does not represent a stock of "hard" money	704
in government vaults. These notes are simply	751
promises to pay money. Neither the government nor	803
the banks are required to keep on hand an amount	852
of standard money equal to their promissory notes	902
which are in the hands of the people.	938
Before a national bank can issue its notes, it	988
must buy government bonds and deposit them with the	1040
Treasurer of the United States. The notes are	1091
printed in Washington and shipped to the bank. The	1155
bank's officials countersign them, and then the	1194
bank pays them out as money.	1223
A very common substitute for paper and metal	1271
money is the bank check. The customer buys goods	1322
and pays by check; the store-keeper takes the check	1374
to his bank, deposits it, and pays his bills by	1422
check. Many transactions are carried on, and only	1474
bank checks are involved.	1500

Exercise 69

THE CHECKING ACCOUNT,--ITS ORIGIN.	37
The merchants in the Middle Ages discovered	85
that, instead of paying a debt in gold and silver,	133
it was safer and more convenient to send an	182
order to the goldsmith, directing him to pay to	230
the person named the sum specified. This is the	280
way our present system of checking began.	322
It can readily be seen that in this procedure	369
of asking a banker to pay out money simply	416
by sending him a written order, some things are	464
very important. It is essential that the cus-	512
tomer write his orders very legibly, in words	558
written in ink so that they cannot be erased or	606
altered. It is essential that the banker be	652
absolutely certain that the signature on the	697
order is the true signature of that customer.	743
Today, our bankers keep for easy reference	789
a card file of all the signatures of its custom-	838
ers. The banks also provide blank checks printed	887
on paper which cannot be erased without its	935
showing. Customers are warned not to write	980
checks in pencil, and to write the figures and	1027
words so that they cannot easily be changed.	1072
It is important for the person receiving	1116
the check to know that the maker of the check	1162
has sufficient money on deposit in his checking	1210
account to cover the check. This person, the	1257
payee, should either cash the check immediately	1305
at the bank on which it is drawn or cash it at	1352
some other bank to get the check started on	1396
the way to be cleared. The writer of checks	1442
should keep an accurate record in his check-	1487
stubs so that he will not overdraw his account.	1535

Schedule for Scoring Timed Writings

Strokes. The actual number of manipulations executed are counted, including the key stroke, shift key, line-lever, tabulator, and backspacer, each of which count as one. On this same basis, omissions are to be subtracted and repetitions added. In the Blackstone C, D, and E, this same method of counting strokes is used in order to compare the results with the Ten-Minute Writings. (This is not the same as appears on the printed tests obtained from the World Book Co.)

Errors. Any one of the following incorrect manipulations is considered an error:

Incorrect symbol, as s for a, t for T, etc. (Uneven touch is not an error if entire outline is discernible.) A strike-over is considered as one error. A double error on the same symbol, as tiik in took is considered as one error.

Piling, crowding more than one symbol in one space.

Transposition of two adjacent letters, such as ie for ei. (mane for name is counted as two errors.)

Omission or repetition of a symbol, word, phrase, or sentence. (For counting strokes, see "Strokes" above.)

Too short a line, less than 61 spaces, except the last line of a paragraph. Too long a line, more than 76 spaces.

At the end of a line, an incorrect division of a word, or an unfinished word. (For counting strokes, see "Strokes" above.)

Failure to space as follows: five spaces for paragraph indentation (and only five); one space after a comma, semi-colon, or a period if the period follows a figure, initial, or abbreviation; two spaces after a colon or after a period, question mark, and exclamation at the end of a sentence.

Failure to line-space a double space (two spaces) between paragraphs (and no more).

V. ADDITIONAL DATA

TABLE 8

MEAN GROSS STROKES AND MEAN STROKE-ERRORS PER 100 STROKES OF EXPERIMENTAL-A AND CONTROL-A CLASSES (38 STUDENTS EACH) OF ELEMENTARY TYPEWRITING STUDENTS, WITH PERCENTAGE RELATIONS, IN TEN-MINUTE WRITINGS, LESSONS 9-51

	Lesson						
	9	11	13	15	†19	21	23
Exp.-A N*	38.0	33.0	32.0	27.0	35.0	31.0	38.0
Mean Strokes	55.0	60.0	68.0	80.0	90.0	103.0	86.0
Mean Errors	4.4	4.3	5.5	5.1	5.0	4.0	3.2
Con.-A N*	38.0	35.0	31.0	31.0	32.0	33.0	36.0
Mean Strokes	44.0	48.0	53.0	63.0	66.0	86.0	75.0
Mean Errors	2.6	1.9	1.6	1.4	1.5	1.3	1.8
Exp./Con. Str.	125%	125%	128%	127%	136%	120%	115%
Exp./Con. Err.	169%	226%	344%	364%	333%	308%	178%
	25	27	29	31	33	35	37
Exp.-A N*	37.0	33.0	38.0	37.0	36.0	32.0	34.0
Mean Strokes	85.0	88.0	109.0	109.0	121.0	122.0	127.0
Mean Errors	2.7	2.2	6.2	6.0	6.3	3.8	5.1
Con.-A N*	36.0	36.0	34.0	37.0	34.0	35.0	34.0
Mean Strokes	83.0	79.0	87.0	86.0	100.0	102.0	107.0
Mean Errors	1.8	1.8	1.4	1.7	1.5	1.2	1.2
Exp./Con. Str.	102%	111%	125%	127%	121%	120%	119%
Exp./Con. Err.	150%	122%	443%	353%	420%	317%	425%
	39	41	43	45	47	49	51
Exp.-A N*	38.0	36.0	33.0	33.0	38.0	34.0	37.0
Mean Strokes	112.0	113.0	114.0	111.0	106.0	129.0	120.0
Mean Errors	2.6	2.2	1.9	2.2	2.3	2.6	1.6
Con.-A N*	23.0	35.0	29.0	31.0	34.0	34.0	32.0
Mean Strokes	118.0	115.0	116.0	117.0	106.0	131.0	126.0
Mean Errors	1.3	1.2	1.1	1.1	1.7	1.3	1.1
Exp./Con. Str.	95%	98%	98%	95%	100%	98%	95%
Exp./Con. Err.	200%	183%	173%	200%	135%	200%	145%

*Number of students in class in given lesson.

†Data for lesson 17 are not available.

